



# **NAVAL POSTGRADUATE SCHOOL**

**MONTEREY, CALIFORNIA**

## **THESIS**

**THE EFFECT OF GRADUATE EDUCATION ON THE  
PERFORMANCE OF AIR FORCE OFFICERS**

by

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March 2007

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**THE EFFECT OF GRADUATE EDUCATION ON THE PERFORMANCE OF  
AIR FORCE OFFICERS**

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## **ABSTRACT**

This thesis investigates the effects of graduate education on the retention and promotion of Line of the Air Force (LAF) officers at the rank of Captain and Major. Logistic regression models are estimated to examine the effects of graduate education on the retention of Captains and Majors and on promotion to Major using data from the Active Duty Military Master File for fiscal years 1992 through 2006 from the Defense Manpower Data Center. A difference-in-difference estimator is incorporated into the promotion model to evaluate the effects of an Air Force policy change intended to eliminate any bias towards advanced education at promotion boards. Besides graduate education, explanatory variables include basic demographic traits and professional characteristics.

Results indicate that graduate education has a positive effect on retention of LAF officers at the rank of Captain and Major. Findings from the promotion model indicate that graduate education also has a positive effect on promotion but results for the change in policy (masking education information for promotion) are inconclusive. In addition, race and career field are shown to influence both retention behavior and promotion while gender significantly affects retention but not promotion.

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## **I. INTRODUCTION**

“The U.S. military is far better trained, better educated, more competent, and more professional than any current or potential rival, which provides an asymmetric advantage in military operations.” (Schilmer, Thie, Harrell, Tseng, 2006). One of the foundations for this continued advantage is the level of graduate education attained by the U.S. military officer corps. Graduate education raises “the levels of individual military officer professionalism and technical competence so that those officers more effectively perform their required duties and responsibilities” along with providing “developmental incentives for military officers with high ability, dedication, and the capacity for professional growth to remain in the Service.” (DODD, 1322.10, August 26, 2004).

In order to maintain this benefit and encourage its officers to pursue graduate education, the Department of Defense (DoD) offers several educational programs to facilitate advanced degrees. These programs include fully-funded in-residence graduate degrees, such as those that can be obtained at the Air Force Institute of Technology (AFIT) and the Naval Postgraduate School (NPS). Alternatively, partially funded off-duty programs are available in which the Services provide tuition assistance, which allows an officer to attend an institution of his/her choosing as long as it does not interfere with his/her normal duties. Examples might include attendance at a local university or a distance learning program. In addition to DoD sponsored programs, an officer may choose to pursue a graduate degree at his/her own expense, which might include the use of any Veteran’s Affairs benefits.

The support of these programs by DoD and the Services is based upon the premise of human capital theory, which suggests that individuals’ productivity increases with additional education and training, along with experience. It is generally understood that education changes an individual in such a way as to increase his/her capacity to perform job-related tasks. (Wise, 1975) This increase in capacity yields productive capital for both the individual and the organization. While benefits for the individual

might include higher earnings, increased promotional opportunities, and greater job satisfaction, the organization also gains through increased revenues, improved productivity, and higher morale.

To illustrate how the Services promote advanced education, the below table shows that a significant proportion of officers attain advanced degrees while on active duty.

Table 1. FY 2004 Education Attainment of Officers by Service

<b>Educational Attainment of Active Component Officer Corps, by Service (Percent) – FY 2004</b>					
	Army	Navy	Marine Corps	Air Force	DoD
Less than College Graduate	1.3	11.9	2.8	2.7	4.2
College Graduate (B.A., B.S., etc.)	58.7	68.5	79.6	46.7	58.2
Advanced Degree (M.A., Ph.D., etc.)	40.1	19.6	17.7	50.6	37.5
TOTAL	100.0	100.0	100.0	100.0	100.0
Columns may not add to total due to rounding. Percentages do not include “Unknown” data. Source: OSD/P&R, Population Representation in the Military Services Report – FY 2004					

The Air Force, like the other services, continues to commit time, effort, and resources to educational programs that promote advanced education. The attainment of a graduate degree in the Air Force is useful not only in meeting the overarching organizational goal of maintaining “knowledge-capital” but also plays a critical role in fulfilling certain specialties in particular career fields and can serve as a differentiator in the promotion process.

## A. BACKGROUND

“In a smaller, leaner, and more expeditionary-focused Air Force, it is essential that our Airmen have the knowledge and competency to accomplish our mission.” (SECAF/CSAF Ltr to Airmen, 2006) One of the most effective ways to build and maintain this knowledge is through the ability of the Air Force to educate officers beyond the baccalaureate level. It is expected that investments in education will yield as much if not more benefit to the Air Force’s capability, as investments in physical capital such as aircraft or equipment, since an educated Airman is considered the foremost weapon

system. Unlike aircraft and equipment that must be constantly updated or modified to meet environmental changes, an educated officer can adapt to changes in the environment.

The Air Force offers various educational opportunities to officers throughout their career. These include Air Force Specialty (AFSC) specific training, Professional Military Education (PME) commensurate with their grade, along with an opportunity to pursue an advanced degree. While each program focus is different, the common thread is the deliberate development of officers. While all officers have the opportunity to pursue off-duty education opportunities, not all officers are able to participate in fully funded, in-residence programs. Reasons for selection or non-selection may include AFSC, grade requirements, and how they rank among their peers. Depending on the nature of the program, participants' degrees may or may not relate directly to the officer's primary AFSC.

While the Air Force has always supported advanced education to develop knowledge, the intent has often been misunderstood. Over time, earning a post-graduate degree was often interpreted by officers as a method to increase the likelihood of promotion. People often used their educational benefits to pursue degrees that may not have been relevant to their core or Air Force duties. As a result, advanced education degrees were masked from promotion records for those competing for the grade of Major beginning in 2003. In doing so, all academic information, to include baccalaureate, was deleted for purposes of the selection board to eliminate any bias towards education. While this had the intended effect of eliminating "square filling," the Air Force also discovered that this change also deterred others from pursuing degrees, that would have benefited officers personally or the Air Force. (SECAF/CSAF Ltr to Airmen, 2006) As a result, beginning again in 2008, all advanced education will again be part of the promotion process.

Today the Air Force finds itself challenged to maintain an effective aerospace fighting force, in an in which equipment re-capitalization and recruiting and retention concerns are at the forefront. While there is an intrinsic expectation that advanced education, regardless of its focus, provides benefits to both the individual and the

organization, the prudent use of limited resources requires that smart choices be made regarding how graduate degrees are resourced. While the benefits of graduate education for the individual officers include improved knowledge and skills along with preparation to assume higher levels of responsibility, the difficulty for the Air Force lies in accurately assessing the performance (productivity) and the return on investment it realizes from investing in each officer's advanced education. Now more than ever, it is important to understand the effect of graduate education programs on performance and retention behavior.

## **B. PURPOSE OF STUDY**

The main purpose of this thesis is to examine the relationship between graduate education and the job performance of United States Air Force line officers. The primary focus for this analysis is addressing any differences in officer performance and retention behavior that may be attributed to graduate education at an officer's career milestones of Captain and Major. Secondary questions that are examined include addressing the perception that graduate education is necessary for promotion, reviewing whether the inventory of graduate education skills differs significantly among communities, and whether a change in Air Force policy regarding masking education records in 2003 had an effect on promotion outcomes.

The data used in this study are taken from the Defense Manpower Data Center (DMDC) Air Force Officer Active Duty Military Master File using cohort data on newly commissioned officers between fiscal years 1992 through 2006. The data exclude non-line Air Force personnel (e.g., chaplains, medical personnel, and judge advocates).

## **C. SCOPE, LIMITATIONS AND ASSUMPTIONS**

The data do not distinguish between fully funded, partially funded, and unfunded graduate education. The interesting question of whether there is a difference in promotion rates and retention behavior between officers having graduate degrees from different sources or the method obtained could not be addressed. Some other factors that

could potentially affect promotion rates and retention behavior, such as awards, certifications, PME completion, and deployment history could not be included in the study because the information was not available.

#### **D. ORGANIZATION OF STUDY**

This thesis is comprised of six chapters. Chapter II is a literature review of prior studies that focus on human capital theory. Literature relevant to labor market economics and the results of prior studies are reviewed to provide context for this research and to assist in the selection of the variables for use in the multivariate models. Chapter III consists of an overview of career progression and graduate education within the Air Force Officer corps. It provides a basic understanding of the current policies and procedures that govern the Air Force Performance Evaluation System, career field management, and graduate education programs. Chapter IV is a description of the database and variables used in this thesis and includes further discussion of human capital theory, its relationship to graduate education in the Air Force, and the effects of graduate education on promotion and retention. Also presented is the model specification and empirical methodology utilized. Chapter V discusses descriptive statistics and model results and their relevance to the effects of graduate education. Chapter VI concludes the thesis with a summary of significant findings, strengths and limitations, and conclusions. Also presented are policy recommendations and areas for further research.

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## **II. LITERATURE REVIEW**

As the most technologically superior and powerful Air Force in the world, we are all aware that we must maintain our intellectual superiority with lifelong education for all Airmen – officer and enlisted...

We must take the Air Force's basic educational foundation to the next level and be relentless in our continued pursuit to become knowledge-enabled Airmen...

Make education a priority throughout your career, and doors will continue to open for you. Your achievements will become a part of your record of success for all evaluations.

-- Honorable Michael W. Wynne, SECAF. (Letter to Airmen, 2006)

### **A. HUMAN CAPITAL THEORY**

According to human capital theory, an individual's productivity and earnings increase with additional education, training, and experience. This phenomenon is examined extensively in the labor economics literature in the same manner as traditional capital investments. It is based on the economic premise that workers embody a set of knowledge, skills, and abilities that can be rented out to employers. If an employee increases his or her skills, then they make themselves more valuable. This set of knowledge and skills, which comes from education and training, including learning that that experience yields, generates a certain stock of productive capital (Ehrenberg and Smith, 2006). This productive capital is often referred to as human capital. The value of this human capital is derived from how much these skills can earn in the labor market.

Human capital can be improved through three major kinds of labor market investments: education and training, migration, and searching for new jobs (Ehrenberg and Smith, 2006). All three investments involve an initial cost, and all three are made with the goal that the investments will yield greater returns in the future (e.g., increased wages, improved productivity, etc.). From an individual's perspective, these investments may have an immediate cost in the form of direct expenses (e.g., tuition, books, etc.) and opportunity costs (e.g., foregone earnings, lost job prospects, etc.). Similarly, an employer may choose to assume or share these costs for an individual. However, in

either scenario, if the initial costs can be recovered with an acceptable rate of return over a specified time period in the form of increased utility (e.g., improved productivity, wages, etc.) then the investment will be undertaken. Just as corporations or individuals assess specific costs and benefits from financial investments, human capital theory assumes that the same assessment criteria can be utilized to characterize the behavior of corporations and individuals when considering investments in human capital. “Like any other investment, an investment in human capital entails costs that are borne in the near term with the expectation that the benefits will accrue in the future” (Ehrenberg and Smith, 2006, 277).

Although all aspects of human capital theory can be related to the military, for purposes of this thesis, only one specific type of human capital investment will be discussed, that of graduate education for United States Line of the Air Force (LAF) Officers. Both DoD and the USAF, have three main reasons for supporting graduate education for military officers all of which support human capital theory. Primarily DoD derives utility by educating its officers through increased productivity, longer retention, and improved morale (Thirtle, 2001).

To better understand the decision to invest in graduate education within the DoD context, four areas of human capital theory need to be discussed: 1) the specificity of the education; 2) the cost and benefits of education; 3) the labor market; and 4) signaling and bias.

## **1. General and Firm Specific Education**

DoD and the Air Force invest in two forms of education to improve the productivity of their officers. The type of investment can be either general or firm-specific in nature. General education refers to knowledge or skills that increase the productivity of the individual with any employer, including the Air Force, or across different job disciplines. This is the type of training received in most undergraduate degree programs, where skills learned may apply equally to a number of enterprises. In the case of Air Force officers, a graduate degree in management or business, for example, could be considered a general investment because it enhances the individual’s productivity across a spectrum of disciplines. General training makes an individual



attractive to a number of firms, and the question becomes, “why would a rational firm provide general training” (Becker, 1962)? The answer, according to Becker, is that firms would only provide general training if they did not have to bear any of the costs. DoD, and specifically the Air Force address this concern by establishing minimum service commitments, which are designed to recoup costs over time. In doing so, DoD ensures a return on its investment from the officer, who is presumed to be more productive during the obligated period. In the words of Becker, “A contract, in effect, converts all training into completely specific training” (Becker, 1962).

Conversely, firm-specific education increases an individual’s productivity only in a specific firm or organization. A large portion of education and training that occurs within DoD is considered firm-specific since it has limited application outside of the military. Further, some education and training may only have limited application to certain jobs within the military. An example of firm-specific graduate education might be a Master’s Degree in Electronic Warfare. Although the core of these courses would be considered a general capital investment and have some universal application, the program mostly enhances the individual’s productivity to DoD and the Air Force. Firm-specific training therefore is in the best interest of the employer when the skills learned cannot be immediately replaced, and would require additional expense to hire or train a replacement. “Reducing turnover of specifically trained personnel is not patronage, but necessary to maintain and improve a firm’s overall productivity” (Becker, 1962). Becker stresses that employees with specific training have less incentive to leave a firm, and conversely, firm’s have more of an incentive to retain them, when compared to employees with general training only.

## **2. Cost and Benefits**

A second area that needs to be discussed is the cost and benefits of investing in human capital. When obtaining graduate education within DoD, one has several options. One can undertake fully-funded in-residence graduate education, partially funded off-duty graduate education or self-funded graduate education. Those considered full-funded attend graduate school full-time at DoD approved Department of Defense or civilian institutions. All education expenses are funded by the Air Force and the individual

continues to receive full pay and benefits. In return for this investment, the individual “owes” the Air Force an active duty obligation period of three years upon graduation for master’s programs and five years for doctoral programs. Additionally, some officers may have to serve in positions requiring a particular Advanced Academic Degree (AAD), since filling the AAD position was the basis for funding the graduate education. The Air Force pays the direct costs of the education as well as the opportunity costs of not being able to utilize the individual during the education period, but is able to reduce its risk by screening applicants not only for academic ability but also for future promotability, while also obligating officers to additional service. Equally, the individual incurs a cost in the form of additional obligated service and missed job opportunities due to being a full-time student, but is able to complete his/her degree in a timelier manner therefore realizing a return sooner.

Individuals in partially funded off-duty graduate education programs attend school in their off-duty time while still receiving full pay and benefits. Tuition is paid for partially or fully by the Air Force through tuition assistance (TA). Any individual utilizing TA is obligated to an additional two years of obligated service upon course completion. Whether an officer takes one or several courses during a given semester for example, he/she is obligated to an additional two-year commitment upon completion of the term. In this instance, the Air Force pays part of the direct costs of the education but does not have to forego the same opportunity costs since the individual is still available for their primary occupation. While the Air Force assumes a greater risk by not being able to screen applicants to the same degree as with in-residence programs, this risk is offset through service obligation and having the officer available for duty. Conversely, the individual may incur some direct costs (e.g., tuition, books, etc.) along with having less leisure time, while also incurring a cost in the form of additional obligated service. On the other hand, an individual pursuing this option has more flexibility in pursuing other job opportunities and not missing on-the-job experiences but may not realize the return on the investment as quickly.

Lastly, an individual may of course choose to obtain a graduate degree at his/her own expense or through utilizing benefits such as through the Veteran's Administration. Under this option, school is completed in his/her off-duty time; however, the officer incurs no additional service obligation to the Air Force. While this alternative avoids an additional service commitment, the individual assumes all direct costs.

In all cases, both the individual and organization undertake some degree of risk with future benefits. This is implicit in the decision to undertake formal education, given the immediate costs and the value of future returns. While the immediate direct costs may or may not be shared by the Air Force, both parties realize a return in the form of increased productivity through increased critical thinking and problem-analysis capabilities (Gates, et al., 1999). From an individual's perspective, this process can be accelerated by completing his/her degree sooner in their career; however, for the Air Force, time may not be as critical given incurred service obligations. A further benefit derived from this increase in education is an increase in motivation or improvement in morale as a result of the increased possibility of future earnings, promotions, and job opportunities. While morale may be difficult to measure, its effect on productivity is without doubt. Additionally, morale and productivity affects retention, which can further increase the return on investment for both the individual and the organization.

### **3. Labor Market**

Given that the military is considered an internal labor market where promotions occur from within, human capital decisions differ slightly as compared to the civilian sector. An internal labor market can be classified as an organization with a single point of entry, where positions are filled through selection and promotion of individuals already in the firm (Oswald, 1984; Rosen, 1992). The term internal labor market first arose in academic literature in 1966 (Doeringer and Piore, 1971) as a means to classify economies internal to large organizations where workers have some probability of promotion to higher positions within the firm with a corresponding increase in wages.

This hierarchical structure with limited entry points exists for several reasons according to Oswald (1984) and Rosen (1992). Specifically, some types of production require that some workers supervise and direct, while others work. Secondly, within this

internal market, workers gain experience and knowledge through production that provides an experienced pool of lower-level workers that the firm may draw upon to fill supervisory positions. Thirdly, through observation of the workers on the job, current employees' ability and potential within that industry can be assessed. This allows employers to observe actual employee characteristics to determine who is retained and how fast and how high the employees are promoted (Ehrenberg and Smith, 2006).

In his analysis, Oswald (1984) arrived at three conclusions that apply to the internal labor market. First, within internal labor markets, seniors are paid more than juniors and if wages decreased with seniority, it would become difficult to fill senior positions. Workers would have no incentive to stay and would leave during their employment in search of opportunities that paid wages independent of age. Secondly, some employees, regardless of seniority, may be paid more than the marginal value of their product. This raises the supply of entrants who find the probability of future returns attractive. As a final point, he asserts that workers can quit if they are not promoted and seek employment elsewhere.

This internal labor market as described is analogous to the environment of military officers. Air Force officers begin their careers by serving in entry-level assignments that build their technical competence in their chosen career field. Over time these competencies are expanded to gain experience and competencies required to fill senior positions. The execution of their duties is continually assessed and quantified by their immediate supervisors. Fully qualified Air Force officers are promoted to Captain (O3), with the first up-or-out point coming at an officer's review for promotion to Major (O4), at approximately the ten-year point. Subsequent reviews or screening occurs for promotion to the higher grades (e.g., Lieutenant Colonel and Colonel). This continuous screening for employment is based on annual performance reports, potential for advancement, and other criteria. The screening is important since the organization must provide continuous firm-specific knowledge and training over time at great expense while ensuring a return on the investment. If an officer fails to be promoted to the next higher grade, current statutes limit additional service and the officer must seek employment outside the military.

Screening allows for the productivity of the officer to be evaluated, which is otherwise difficult to measure. This is especially true in the military, where officers serve in more managerial/leadership roles as they become more senior. In this role they produce output indirectly by making others more productive, and the output of the Air Force is national defense, which is not readily amenable to measurement and valuation (Cymrot, February 1986). In support of this screening, rank or position can be a valid measure of productivity according to Rosen (1992) and an Army organization study (Jacobs & Jacques, 1991). This is a result of the responsibility associated with higher positions, which necessitates screening to ensure the long-term success of the organization. This screening ensures that not all officers rise through the ranks. These screens consider not only performance potential, but also motivation of an officer to realize that potential (Rosen, 1992). Internal labor markets foster this motivation since “outsiders” or those junior are not considered for promotion consideration.

Given that DoD is a closed labor market with a fixed pay scale dependent on only rank and time in service, the expected return of higher future earnings attributed to improved performance cannot be realized while on active duty. Rather, higher probability of promotion during active service is one of the expected benefits for officers pursuing graduate education. While the decision to participate in graduate education may be motivated in part to maximize post-service benefits (e.g., higher earnings and employment opportunities as a civilian), its may also be influenced by signaling, which can be viewed as an alternative screening device.

#### **4. Signaling and Bias**

Signaling theory is based on the idea that a worker conveys some meaningful information about his/her ability to an employer by his/her choice or level of education. Signaling asserts that organizations use formal schooling as a screening device to identify the most productive workers, since an employer may not possess complete information about a worker’s ability. The theory asserts that the decision of an individual to obtain formal or advanced education is a signal of the true productivity of the individual. It is based on the assumption that those who pursue education tend to have personal characteristics (e.g., commitment, discipline, drive) that are correlated with higher

productivity. Using this theory, an individual with graduate education is signaling that he/she is more productive than an individual who does not possess one, when a choice is being made between otherwise identical resumes. Equally, an employer is able to use this information as a means to screen out potentially less productive workers.

With respect to the Air Force and its officers, signaling theory implies that officers who participate in graduate programs send a signal that identifies them as productive officers. This concept is reinforced since signaling theory states that an employer will not be willing to fund advanced education unless it is less costly than using some other productivity measurement tool to identify the most productive workers. However, the use of signaling or screens can often be skewed by biases.

These biases are based on self-selection or on ability differences. Ability bias can lead to the returns on education to be overstated. Overstating the influence of education occurs when the return is attributed in whole to the performance-enhancing effect of education versus taking into account other factors. The role of ability bias is “people who are smarter and more dynamic are likely to obtain more schooling and might be more productive even if they did not complete more years of schooling” (Ehrenberg and Smith, 2006). Therefore, not taking into account the innate abilities of individuals who acquire graduate education overstates the performance benefit of advanced education.

Self-selection bias can lead to the returns on education either being overstated or understated. Self-selection bias is the tendency for individuals to choose or abstain from participating in activities, such as graduate education, based on some characteristic (e.g., attitude or motivation) that is not observed. Further, an individual may exhibit certain behavior in response to organizational controls, be they perceived or real. Those who are academically talented or enjoy academia for example, are more likely to self-select into graduate programs, as compared to those who are “academically challenged” or enjoy other pursuits, whom would be less likely to participate. Thus, depending on one’s aptitude and attitude towards graduate education, self-selection bias can cause the returns attributed to graduate education to be inaccurate.

Self-selection bias plays an even greater role within an internal labor market. It has been characterized as a pricing scheme used by a firm to ensure only qualified individuals apply for positions (Salop & Salop, 1976). Self-selection plays an important role in the internal labor market concerning costs and benefits. In this respect, officers who expect future returns to equal or exceed current costs will choose to stay in the military whereas those who do not expect greater returns will choose to seek employment elsewhere. Similarly, those who choose to pursue graduate education are accepting some opportunity cost and the perceived effects on their career.

Given these considerations, it is easy to see the difficulty in conducting research on the returns to graduate education. Yet research is essential in providing insight for organizations to assist with evaluating performance and developing retention and promotion policies. While there is no perfectly accurate method for doing so, research into this area is an important means to explain the relationship between performance and education.

## **B. RELEVANT PAST STUDIES**

### **1. Studies by Wise (1975)**

In 1975, David Wise, conducted two studies that were published in the *American Economic Review* and *Econometrica*, respectively, to investigate some of the concerns with human capital theory. In his initial study, “Academic Achievement and Job Performance,” Wise addressed whether academic achievement was related to job performance and whether this relationship was due to personal characteristics or other cognitive skills gained in school. His study made use of an ordinary least squares model that used salary as a dependent variable with explanatory variables including level of education, employment experience, and other personal characteristics. This approach allowed him to use salary as a proxy for productivity. The results indicated that nonacademic attributes, such as initiative and leadership, were as important as academic abilities in determining job performance. Employees with graduate degrees and who were at the top 5% of their class received the highest salary increases in the model. He found that graduate education was correlated with higher job performance in accordance with human capital theory.

In his second study, “Personal Attributes, Job Performance, and Probability of Promotion,” Wise addressed the same questions as in his previous study with the same data and explanatory variables, but unlike his first study, he utilized a maximum likelihood technique to estimate the relation between promotion and education. He hypothesized that a person’s rate of promotion might be a more direct measure of job performance than the rate of salary increase given the problem that salaries are assigned to positions rather than to individual employees, similar to the DoD military and civilian pay systems. Therefore, salary may not be an accurate measure of an employee’s performance. Moreover, salaries are usually adjusted based on length of service versus performance, and thus employees often receive annual raises despite not actually being promoted. This practice is common in both government and many large, private organizations. Ironically, Wise’s results were consistent with his previous study. In his study, a graduate degree had a greater effect, on the promotion probability than it had on salary. Specifically, the probability of promotion for master’s degree holders was approximately 43.2 percent, assuming other variables were at their means. Additionally, nonacademic characteristics remained as important as the effect of academic achievement on job performance.

## **2. Studies by Medoff and Abraham (1980/1981)**

Contradicting studies conducted by Wise was research by James Medoff and Katharine Abraham that was published in the *Quarterly Journal of Economics* in 1980. In their article, “Experience, Performance, and Earnings” the researchers obtained some results that appeared to contradict previous human capital theory research. The focus of their research was on whether additional earnings resulting from additional human capital investment could be explained by higher or increased work productivity. While the data were limited to only white males, it included information on education, length of employment, work location, current job grade, date of entry into current job grade, and salary information. The data also included measures of the employee’s performance as well as an assessment of his/her potential for advancement based on a committee evaluation rather than on an evaluation by a single supervisor.



The authors estimated a semi-log salary in their first model, excluding grade information, and the results were consistent with human capital theory. Employees possessing a high school diploma or less received 13-23 percent lower earnings as compared to college graduates. Whereas those individuals possessing a master's degree or doctorate increased their earnings 10 percent and 21 percent, respectively. Prior experience and years with the organization were also significant factors in positively influencing salary.

In their second model, grade levels were included to determine wage differences within in each grade. In these models, the coefficients of education dropped significantly. The effect of a master's degree on salary declined from 10 percent to just 2 percent. This indicated that those possessing a master's degree were assigned to jobs with higher grades. Corresponding to this change, prior experience, and years with the organization also lost their influence on salary. The authors ran one additional iteration with both performance and grade criteria included and the results derived were similar to the second model. This implied that performance ratings could not explain the effect of explanatory variables such as experience and education.

The same team published another study in 1981 in *The Journal of Human Resources*, "Are Those Paid More Really More Productive: The Case of Experience," which analyzed the relationship between experience and job performance using cross-sectional longitudinal data that used performance ratings as an indicator of performance. The team wanted to explore whether better earnings signified that more experienced employees were more productive than their less experienced co-workers. The team used the same data set from their initial study and estimated a semi-log salary model. The results were similar to their first study; however of particular note was that when dummy variables were inserted to represent performance within each grade, the coefficients did not converge towards zero. This result indicated that a person who received higher earnings based on his/her performance appraisals, performed no better than less senior co-workers in the same grade. This was unusual in that it contradicted normal human capital theory that ties experience to earnings and supports the concept that within

comparable jobs there is no association between additional human capital and performance. However, the study does capture the dynamics associated with an internal labor market where an employee may be paid more than their marginal value.

### **3. Study by Cymrot (1986)**

In research for the Center for Naval Analysis, Donald Cymrot specifically examined human capital theory for Navy officers in his study “Graduate Education and the Promotion of Officers.” The principle purpose of the study was to examine the effects of fully funded graduate education on the promotion of Navy officers since promotion can be an indicator of productivity. He utilized a cross sectional database constructed from the 1985 Officer Master File. All officers from the ranks of O4 through O7 were examined. The study used a logistic regression (LOGIT) model with promotion as a proxy for individual performance to examine the impact of graduate education along with other officer demographics (e.g., age, sex, time in service, etc.).

Results of the study showed that graduate education is statistically significant in explaining promotion to the ranks of O4, O5, and O6, but not to O7. Further, results indicated that officers who complete an advanced degree are more likely to be promoted as compared to those who do not. Specifically, the probability of promotion to O4 and O5 increased by 26 percent and 10.5 percent, respectively. The results of the study also assert that annual performance evaluations, promotion, and retention are all valid productivity indicators.

One weakness of this particular study, however, was the fact that the officers analyzed were a subset of the officer cohort since they had been selected for in-residence education, thus creating bias. While the author recognized that selection for fully funded graduate education is contingent upon potential (e.g., promotability) and may create bias, the study did not attempt to correct for it. As a result of this selection bias, the impact of graduate education may be overstated. Additionally, self-selection bias is a concern since individuals may self-select into in-residence education programs as a means to improve promotion probability.

#### **4. Study by Jordan (1991)**

In a master's thesis by Susan Jordan at the Naval Postgraduate School, the author analyzed the effects of graduate education on the performance and retention of U.S. Navy General Unrestricted Line (GURL) Officers. Specifically, the author was interested in determining the how graduate degrees from the Naval Postgraduate School and other institutions affected the probability of promotion to Lieutenant Commander (O4) and Commander (O5), and on retention to the same ranks. At that time, GURL officers were predominately women and they performed staff functions.

Data were derived from DMDC that combined Officer Promotion History Data Files and the Officer Master Record Files. Data elements included demographic, educational, experience, and selection board data on all officers, both active and reserve, in paygrades 0-2 (LTJG) through 0-7 (RADM) from 1981 through 1990. To analyze the effects for the two study areas, logistic regression models were used to examine the probability of voluntarily staying in the U.S. Navy and being promoted or voluntarily leaving the Navy.

Results indicated that graduate education had a positive impact on the probability of promotion to Lieutenant Commander, with those attending the Naval Postgraduate School, an in-residence program, showing a stronger effect than other educational institutions. This in part could be attributed to screening on the part of the Navy for future potential along with potential careerists signaling their willingness to attend graduate school in-residence with the expectation of future returns. No significant effect was noted for promotion to Commander. Graduate education was found to have a significant impact on retention prior to the Lieutenant Commander selection point but the results for retention to the Commander selection level were insignificant. In all samples, both an NPS degree and a degree from other institutions significantly decreased the probability of leaving the Navy. The author hypothesizes that this could be in large part explained by the additional service obligation incurred. While the results of this thesis are consistent with human capital theory, of concern was the small size of the population studied along with the limited occupations surveyed, which limit the applicability of the results.

## **5. Study by Alley, et al. (1995)**

In 1995, a group of Air Command and Staff College students and faculty were tasked with investigating how to best assure off-duty education opportunities for Air Force personnel. The team examined the broad facets of off-duty, voluntary education programs, including value to the Air Force and the individual, cost versus return on investment, and relationship to career progression. Specific focus was placed on understanding the importance of tuition assistance with respect to recruitment, retention, and individual motivation.

The study made use of a qualitative methodology that was comprised of reviewing job advertisements and educational surveys to gain a greater understanding of required and perceived educational needs for both officer and enlisted personnel. For purposes of this review, the focus will be on the results obtained for the officer corps.

Content analysis was the research technique employed to review job advertisements to make inferences about characteristics required to fill vacancies based on key words or phrases. The areas reviewed were communication (briefing and writing), leadership (functions of management and supervising), and degree desired/mandatory to meet the prerequisites of the job. Additionally, researchers created a final category, “Advanced Management-Related Degree” to record the researcher’s assessment that an advanced degree would be useful for the described job. A management-related advanced degree was selected because historically that tended to be the most popular type of degree conferred upon military officers. To make this assessment objective, researchers excluded any jobs that advertised that an advanced degree was desired or mandatory. Secondly, the categories of communication and leadership were used as indicators of a need for particular skills that might be enhanced by an advanced degree. Using these data, a weighted scoring system was employed to determine whether an advanced management degree was desirable to meet job requirements. Briefing and writing outcomes were assigned a score of 1 each, if required for the job, since the outcomes were narrow. On the other hand, the functions of management and supervising being broader and more significant skills were assigned a score of 2 each, if required. Using this information, 3,506 job advertisements were

reviewed and if a job advertisement received an overall score of 3 or better, it was recommended that it be filled by someone possessing an advanced degree in a management related discipline.

The tuition assistance (TA) and off-duty education survey was developed to establish an opinion-oriented baseline on TA and generic education programs. The survey was administered to 2,290 officers and enlisted personnel. It requested personal background (e.g., highest educational level attained, current grade, etc.), knowledge of TA (e.g., are you familiar with TA, have you used TA, etc.) and their opinion on the education program (e.g., effects of educational programs on joining and staying in military, should degrees be major factors in promotion, etc.)

Results of the content analysis indicate that one is more likely to come across jobs that either express or imply that an advanced degree is desirable among field grade officers (O4 and above) as compared to company grade officers (O3 and below). In addition, the promotion statistics suggest that officers currently tend to complete their advanced degree around the time they make the rank of Major (O4). The survey results indicate that there is a strong perception among officers that having an advanced degree is a major factor in officer promotions. “To continue this train of logic, field grade level is around the time that officers are expected to become less a specialist and more a generalist” (Alley et al., 1995).

While this study did not provide any statistical evidence that advanced education improves productivity as measured by promotion or retention, it did provide evidence that a perception exists that education is a consideration in the promotion process. While education may not be directly correlated to promotion, results indicated that education is an avenue to filling higher-level jobs, which allow individuals to be more competitive for promotions. Further, the study highlighted that personnel believe that their human capital can be improved through education, even though this may be difficult to quantify, and that education benefits are perceived as a good benefit.

## **6. Study by Bowman and Mehay (1999)**

In a similar study to the 1986 research by Cymrot, Bowman and Mehay analyzed the effect of a master's degree on the probability of promotion to O4 for naval officers. Differing from the Cymrot study, the authors wanted to address concerns about bias, either those associated with self-selection or by the Navy's selection process. In order to do so, the authors used a unique database consisting of 4,471 line and staff officers in the Navy's Promotion History File between 1985 and 1990, which was augmented with fitness reports (annual performance reports) prior to the promotion to O4. The data was then grouped into explanatory variables, based on their characteristics, into the following groups: cognitive traits (GPA, undergraduate degree, graduate degree, etc.); affective traits (accession source); and demographic traits (age, race, sex, etc.).

Using sequential modeling that utilized probit techniques, four models were developed to estimate the effects of graduate education on promotion. In each modeling step, the authors attempt to isolate the effect of graduate education on promotion and to control for variables that may influence the promotion process. In the first model, only graduate education is examined and in the subsequent models, demographic traits, cognitive traits and, affective traits are added.

Initial results indicated that line and staff officers with a master's degree were promoted at rates of ten and fourteen percent greater than officers not possessing degrees respectively. However, the educational impact is reduced as the different traits are added that account for unobserved factors that relate to both self-selection and competitiveness for promotion. This reduction in biases is accomplished using a bivariate probit model. As a result, the marginal effects of graduate education on the probability of promotion decreases by approximately 40 and 50 percent for line and staff officers, respectively.

In the same study, Bowman and Mehay also analyzed the effect of in-residence (fully funded) graduate programs to examine whether there was any differences between firm specific training, in-residence programs, and general training programs, and their associated impact on promotion. This was accomplished by comparing individuals who possess a master's degree, either in residence or through other means, with those who did not possess one. The results revealed that the return to in-residence graduate education

for line officers was nearly double as compared to those just possessing a master's degree from a non-residence program. Similarly, for staff officers, the return was 20 percent higher. Results are shown below in Tables 2 and 3. The tables also highlight the presence of selection bias by the Navy for in-residence programs when compared to other master's programs (e.g., off-duty). When the single-stage model controlled for performance and ability, the return to the Navy funded Master's for line officers decreased by one-half, whereas it only dropped about one-third for any other master's degree. Staff officers had comparable results with the return to any master's degree reduced by two-thirds and the return to an in-residence master's degree reduced three-quarters.

Table 2. Coefficient of any master's degree in single stage and bivariate probit models

	<b>1. No Controls for ability/performance</b>	<b>2. Controls for ability/performance</b>	<b>3.a. Bivariate probit</b>
Line Officers	.376 (0.073) <sup>a</sup> [0.098] <sup>b</sup>	.265 (0.065) [0.065]	.198 (0.077) [0.056]
Staff Officers	.503 (0.063) [0.145]	.376 (0.073) [0.089]	.188 (0.108) [0.051]
Source: Bowman and Mehay, "Graduate Education and employee performance: evidence from military personnel"			

<sup>a</sup> – Standard errors in parentheses.

<sup>b</sup> – Marginal effects in brackets.

Table 3. Coefficient of fully funded master's degree and bivariate probit models

	<b>1. No Controls for ability/performance</b>	<b>2. Controls for ability/performance</b>	<b>3.a. Bivariate probit</b>
Line Officers	.605 (0.067) <sup>a</sup> [0.148] <sup>b</sup>	.460 (0.074) [0.093]	.170 (0.062) [0.045]
Staff Officers	.615 (0.072) [0.172]	.440 (0.086) [0.101]	.154 (0.065) [0.046]
Source: Bowman and Mehay, "Graduate Education and employee performance: evidence from military personnel"			

<sup>a</sup> – Standard errors in parentheses.

<sup>b</sup> – Marginal effects in brackets.

From these results, the authors concluded that both firm-specific and general types of investments provided a positive return to officers in the Navy, and overall, officers possessing a master's degree, regardless of source, were more likely to be promoted to O4.

The Bowman and Mehay study takes into account both observable and unobservable factors that may influence promotion along with addressing any selection bias that may exist. Further, the research captures the dynamics associated with an internal labor market and supports the positive relationships between human capital investment and performance. One area of concern with the research was possible differences between occupations that could not be captured by the grouping methodology used and the question of whether returns would be similar when modeled for higher grades.

## **7. Study by Kabalar (2003)**

In a Naval Postgraduate School master's thesis, Hakan Kabalar analyzed the effect of graduate education on promotion to Lieutenant Colonel (O5) in the U.S. Army. The author used data from fiscal years 1981 to 2001 obtained from DMDC as cohort data sets that contained both demographic, professional, and promotion variables. Demographic variables used consisted of gender, race, age, marital status and number of dependents. Professional factors used were education, commissioning source, DOD primary occupation code and prior enlisted experience. Combining the nine predictor and one response variable, promotion to O5, Kabalar examined how personnel who entered military service in 1981, 1982, 1983 performed using logistic regression and classification tree models.

Using these models, he explored the effect of each predictor variable on promotion to O5. The results indicated that officers with graduate education have higher promotion probabilities. The estimated odds ratio for graduate education was within a range of 1.79 to 2.25 suggesting that the promotion odds ratio among officers with graduate degrees is 1.79-2.25 times the same ratio for officers without graduate degrees.



Another effect discovered was that Academy or ROTC/Scholarship graduates have higher promotion probabilities compared to officers from other commission sources highlighting that early screening by the Army may be occurring prior to commissioning and that career-minded individuals may self-select to attend these institutions. This corresponds with previous studies that highlighted the findings that commissioning source plays a role in promotion outcomes and therefore must be considered when examining the effects of graduate education. Of further interest were the variables for DOD primary occupation code (e.g., civilian equivalent for MOS/AFSC), which were found not to be statistically significant. This suggests that the Army does not differentiate between occupations in the promotion process, all other factors being equal.

### **C. CHAPTER SUMMARY**

This chapter reviewed labor economics theory and prior studies that are relevant to this thesis. In particular, the methodologies used by Wise, Jordan, and Kabalar provide a framework for this thesis. The other studies provide insight into the dynamics of internal labor markets and considerations that should be included when examining the effects of graduate education.

While there have been numerous studies conducted to determine the effect of graduate education on civilian organizations and within the Department of the Navy, there have not been many similar studies for the Department of the Air Force that focus solely on graduate education. Rather, the Air Force has focused on the benefits of Professional Military Education, especially in looking at promotion rates. However, these studies provide a basis for examining the effects of graduate education on Air Force officers since the promotion policies, personnel systems, and hierarchical system are common within DoD and similar to large, private organizations.

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### **III. AIR FORCE OFFICER SYSTEM**

This chapter discusses in general the officer development of Line of the Air Force Officers (LAF) including classification, evaluation, and promotion through the rank of Major. It concludes with a review of the graduate education system available to Air Force officers. While the Defense Officer Personnel Management Act of 1981 established a common officer management system for DoD that created a uniform concept regarding how officers should be accessed, trained, and promoted, all the services interject their own unique features into the process of developing officers. This development includes training, education, and assignments that prepare an officer for their primary duty but also combines skills and experiences so they understand the broader Air Force and DoD perspectives.

Commissioning into the officer corps is done primarily through the Air Force Academy (AFA), Reserve Officer's Training Corp (ROTC), or through Officer Training School (OTS). However, other non-traditional means exist including direct appointments or through the National Guard Academy of Military Science. Historically, the largest portion of officer accessions has come from ROTC followed by the AFA and OTS. Roughly, 20 percent of the officers are commissioned through the Air Force Academy, 43 percent through Reserve Officer Training Corps, 21 percent through Officer Training School, with the remaining 16 percent from other sources. Upon accession, a career progression in the Air Force may follow varying paths depending upon occupation and other factors; however, professional development, evaluation, and performance are consistent regardless of occupation.

#### **A. AIR FORCE OFFICER CLASSIFICATION**

All Air Force officers are classified by their occupation in order to identify individuals possessing the skills needed to fill Air Force requirements. This classification is accomplished using Air Force Specialty Codes (AFSC) along with prefixes, suffixes, and other identifiers. The flexibility of the system allows identification of highly skilled specialists as well as broad generalists. This system of classification is based on Air Force Specialties (AFS), in which positions are grouped based on similar functions and

requirements for knowledge, training, experience, etc. These AFSs are further combined into broader and more general functional categories called career fields. This functional grouping provides a classification and utilization system that remains stable regardless of changes in organizational structure and provides a framework to access, train, and develop specialized and broadly experienced personnel. Further, it provides a framework for upgrading and retaining officers for career progression.

Each AFS is identified by an AFSC and has a specialty title and an occupational description contained in AFMAN 36-2105. This results in every officer having an assigned Air Force Specialty Code (AFSC). In order for an officer to be awarded most AFSCs, mandatory qualifications must be met, and other qualifications may be required for upgrade or retention of the AFSC. Normally, officers will remain within their particular AFS during the duration of their career; however, they may choose or be selected to work outside their AFSC or career field. This is generally done for career broadening or to develop a wider range of knowledge required for later in their career. While they may assume a different duty AFS, their primary AFS will not change unless they are re-designated into a new AFS. All Air Force officers are considered line officers unless they are part of a professional or medical occupation. A summary of the line AFSs is listed in Table 4 below, which displays how the AFSCs are grouped by career field according to AFMAN 36-2105. These groupings fall into six major areas: 1) operations; 2) logistics; 3) support; 4) acquisition and financial management; 5) special investigations; and 6) special duty/reporting identifiers. Of note is that those officers holding a special duty/reporting identifier are normally from another AFS and assume that AFS for the duration of the assignment, keeping their primary AFS as mentioned above. Upon completion of the assignment, the officer will return to their primary AFS.

Table 4. Officer Classification Structure

OPERATIONS	
10C0	Operations Commander
<b>Pilot</b>	
11BX	Bomber Pilot
11EX	Test Pilot
11FX	Fighter Pilot
11GX	Generalist Pilot
11HX	Helicopter Pilot
11KX	Trainer Pilot
★11MX	Mobility Pilot
11RX	Recce/Surv/Elect Warfare Pilot
11SX	Special Operations Pilot
11UX	Remotely Operated Aircraft
<b>Navigator</b>	
12BX	Bomber Navigator
12EX	Test Navigator
12FX	Fighter Navigator
12GX	Generalist Navigator
12KX	Trainer Navigator
★12MX	Mobility Navigator
12RX	Recce/Surv/Elect Warfare Navigator
12SX	Special Operations Navigator
12UX	Remotely Operated Aircraft
<b>Space, Missile, and C2</b>	
13AX	Astronaut
13BX	Air Battle Manager
13DX	Control and Recovery
13MX	Airfield Operation
13SX	Space & Missile
<b>Intelligence</b>	
14NX	Intelligence
<b>Weather</b>	
15WX	Weather
<b>Operations Support</b>	
16FX	Foreign Area
16GX	Air Force Operations Staff Officer
16PX	Intl Politico-Military Affairs
16RX	Planning & Programming
LOGISTICS	
20C0	Logistics Commander
<b>Logistics</b>	
21AX	Aircraft Maintenance
21BX	Maintenance
21MX	Munitions and Missile Maintenance
21RX	Logistics Readiness
SUPPORT	
30C0	Support Commander
<b>Security Forces</b>	
31PX	Security Forces
<b>Civil Engineering</b>	
32EX	Civil Engineer
<b>Communications</b>	
33C0	Communications Commander
33SX	Communications and Information
<b>Services</b>	
34MX	Services
<b>Public Affairs</b>	
35BX	Band
35PX	Public Affairs
<b>Mission Support</b>	
36MX	Mission Support
36PX	Personnel
<b>Manpower</b>	
38MX	Manpower
ACQUISITION	
<b>Command</b>	
60C0	Program Director
<b>Scientific Research &amp; Development</b>	
61SX	Scientist
<b>Developmental Engineer</b>	
62EX	Developmental Engineer
<b>Acquisition</b>	
63AX	Acquisition Manager
<b>Contracting</b>	
64PX	Contracting
<b>Finance</b>	
65AX	Auditor
65FX	Financial Management
65WX	Cost Analysis
SPECIAL INVESTIGATIONS	
71SX	Special Investigator
SPECIAL DUTY IDENTIFIERS	
80C0	Commander, Cadet Squadron, USAFA
81C0	Training Commander, OTS
81T0	Instructor
82A0	Academic Program Manager
83R0	Recruiting Service
84H0	Historian
85G0	USAF Honor Guard
86M0	Operations Management
86P0	Command and Control
87G0	Inspector General
88A0	Aide-de-Camp
REPORTING IDENTIFIERS	
90G0	General Officer
91C0	Commander
91W0	Wing Commander
92J0	Non-designated Lawyer
92J1	AFROTC Educational Delay-Law Student
92J2	Funded Legal Ed Program Law Student
92J3	Excess Leave Law Student
92M0	Heath Professions Scholarship Program (HPSP)
	Medical Student
92M1	Uniformed Services University of Health Sciences Student
92M2	HPSP Biomedical Science Student
92R0	Chaplain Candidate
92S0	Student Officer Authorization
92T0	Pilot Trainee
92T1	Navigator Trainee
93P0	Patient
94N0	Nuclear Weapons Custodian
95A0	Non-Extended Active Duty USAFR Academy/CAP Liaison Officer
96D0	Off not Avail in awarded AFSC for cause
96U0	Unclassified Officer
96V0	Unallotted
97E0	Executive Officer Above Wing Level

Source: AFMAN 26-2105, *Officer Classification*

## **B. AIR FORCE OFFICER PROGRESSION**

While it would be difficult to summarize how each officer should progress during his or her career given the unique requirements of each AFSC, some generalizations about career progression are universal and provide a baseline for understanding how officers are developed. In short, Air Force officers are developed through leadership opportunities, education and training, and experience over their assignments to perform in their specialty while at the same time “growing” them as future leaders. This “growing” process is in large part based on officers’ first gaining proficiency in their specialty, then in their career field, and then finally as an aerospace specialist. This development process is based on each career field’s skill requirements along with the member’s background, aptitude, and desires; however, all officers receive the same developmental education, such as through PME.

Accessions into a particular career-field primarily occur at the O1 level, with a small number of lateral accessions occurring later through transfers of officers from other career fields. Most newly commissioned officers (O1) are assigned to formal training before their initial duty assignments. The length of formal training will vary according to the career field. For the first several assignments, the goal is to build technical competence within the chosen career field, which might include leadership assignments along with completion of basic developmental education, which include the Air & Space Basic Course and Squadron Officers School, and any career-field-specific training requirements. Opportunities may be available at this time for special duty, which might include instructor duty or a tour as a foreign affairs officer. Further, if the officer is in a career field with advanced academic degree requirements, he/she may be selected to earn an advanced degree. Assignments usually include several years at the base-level or an equivalent organization and a staff tour at a headquarters and may include several deployments. This time span will usually encompass the grades of O1 through O3 or roughly ten years.

As an O4, an officer will have developed proficiency in his or her core career field and will begin to broaden their knowledge base through other staff tours that might include tours at the Pentagon or joint duty assignments along with deployments. Some

officers at this time may laterally transfer into new career fields or complete special duty tours to broaden their knowledge of Air Force operations. At this point, officers will begin assuming more senior leadership positions at either staff or wing-level organizations commensurate with their grade and experience. Intermediate developmental education during this time might include Air Command and Staff College, an assignment to the Naval Postgraduate School or the Air Force Institute of Technology, or other PME schools. Assignments might also include tours as squadron commanders or directors of operations. This period encompasses roughly five years and several assignments may occur during this time.

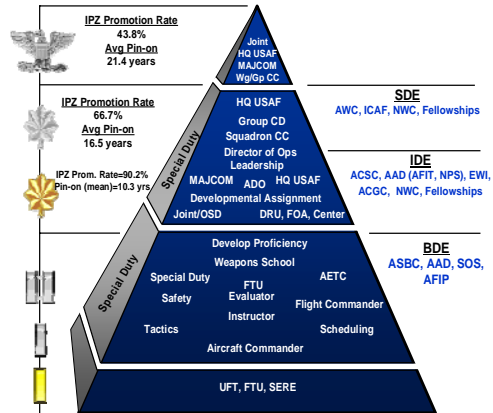
To provide an overview of how different career fields progress, Figure 1 below, illustrates typical career field dynamics for two AFSs, one in operations, the other in support. Of particular note, the figure illustrates how each career area has differing assignment possibilities along with opportunities to complete in-residence graduate education programs, such as AAD, the Air Force Intern Program (AFIP), along with PME. Further, given operational and training requirements, some career fields may experience more limited opportunities at certain grades to attain in-residence education as compared to officers in other areas, especially concerning advanced academic degree requirements.

For example, in the case of the security forces officer, the pyramid below illustrates that during the first several years, a member will serve as a flight commander or officer-in-charge. During this time period, they will attend formal AFS training such as the ground defense course along with PME commensurate with their grade. As Captains, they will have the opportunity to serve in staff positions and may attend additional AFS specific training such as at the FBI Academy. However, there is limited opportunity to complete in-residence education unless they are selected for AFIP. While an officer can complete an advanced degree off-duty, for the majority of officers the first real opportunity would be as Majors, where more chances are provided, such as through NPS or AFIT.

## Operations

### 11F Fighter Pilot

#### Career Pyramid



Notes:  
IPZ rates calculated AF wide  
\*CBMC open to Capt/Maj with 8-12 CYOS

## Support

### 31P – Security Forces

#### Career Pyramid

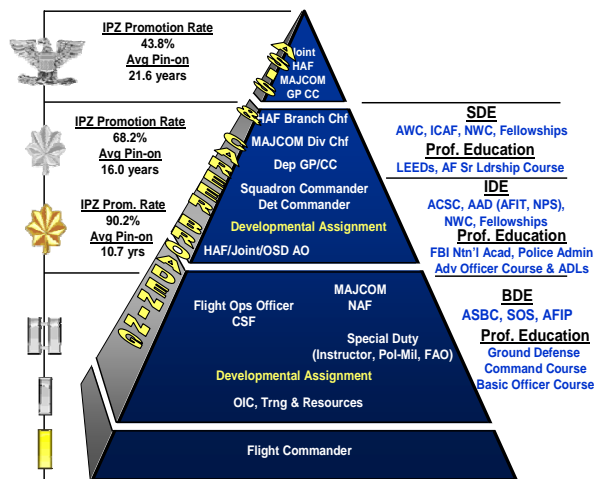


Figure 1. Career Pyramid

Source: [http://ask.afpc.randolph.af.mil/main\\_content.asp?prods1=1&prods2=244&prods3=247&p\\_faqid=6022](http://ask.afpc.randolph.af.mil/main_content.asp?prods1=1&prods2=244&prods3=247&p_faqid=6022)  
(March 2007)



### **C. AIR FORCE EVALUATION AND PROMOTION**

The Air Force officer evaluation and promotion program's purpose is to select enough officers of the desired quality and grades to carry out the mission. To accomplish this end, the Air Force promotes officers in sufficient numbers as vacancies occur, maintaining the strength of the Air Force in each grade, and providing reasonable progression to retain a qualified officer corps.

The Air Force screens officers for promotion based on their potential to successfully serve in the next higher grade and in positions of greater responsibility. The criterion the Air Force uses to evaluate each officer's relative potential is known as the "whole-person" concept per AFPAM 36-2506. This "whole-person" concept includes such factors as job performance, breadth and depth of experience, academic and professional military education along with specific achievements that include awards and decorations. Industry uses similar screening factors to ensure jobs are filled by people who will be productive in positions along with other considerations such as job-match.

Officers are evaluated on an annual basis, normally, to provide an accurate appraisal of performance. Supervisors document each officer's performance and impact on the unit's mission on an Officer Performance Report (OPR). OPRs, in conjunction with education and training reports, letters of evaluation, and other "whole person" criteria covering the officer's entire career, are then used to write a Promotion Recommendation Form (PRF) by the officer's senior rater to determine promotion potential.

There are three elements to the officer promotion process: eligibility; selection; and promotion. Laws, regulations, and administrative procedures control each. These are interrelated and driven by: Authorized strength (the number of officers in a particular category specified for a grade or combination of grades); the promotion flow point (the number of years of commissioned service at which most officers would be promoted to the next higher grade); and the promotion percentage (the number of officers in the promotion zone to be selected.). These factors are interrelated and cannot be separated from each other; a change in one will force a change in the others.

The typical promotion for LAF officers is portrayed below in Table 5; however, as already explained, it may vary from year to year. However, this chart provides a good estimate on when promotions occur. The promotion system is “blind” to AFS requirements and focuses, rather, on selecting those “best qualified” regardless of occupational specialty.

There are three promotion zones for officers in the same grade who are eligible for promotion consideration. They are the following: Above-the-Promotion Zone (APZ), Below-the-Promotion Zone (BPZ), and In-the-Promotion Zone. APZ indicates the officer’s “late” consideration for promotion. These officers have previously failed IPZ selection to the next grade and are senior to officers being considered IPZ. BPZ indicates the officer’s “early” consideration for promotion. Officers are eligible BPZ at the two boards immediately preceding the board in which they are considered IPZ. BPZ applies to O5s and above. Officers eligible for BPZ are always junior to officers being considered IPZ. IPZ indicates the officer’s “on-time” consideration for promotion to the next grade based on his or her current date of rank. The opportunity for promotion is highest when officers are IPZ. It should be noted that officers in the grade of O4 or O5 who are not selected for promotion may remain on active duty until they have reached 20 years of commissioned service.

Table 5. Officer Promotion Structure

<b>Rank</b>	<b>Time in Service</b>	<b>Time in Grade</b>	<b>Process</b>
<b>02</b>	2 Years	2 Years	Fully Qualified
<b>03</b>	4 Years	2 Years	Best Qualified-Selection Board
<b>04</b>	9-11 Years	3 Years	Best Qualified-Selection Board
<b>05</b>	15-17 Years	3 Years	Best Qualified-Selection Board
<b>06</b>	21-23 Years	3 Years	Best Qualified-Selection Board
Source: AFPAM 36-2506, <i>You and Your Promotions – The Air Force Officer Promotion Program</i> , and DoDI 1320.13, <i>COPRs and Procedures</i>			

The PRF is then used by a promotion selection board to determine which officers should be selected for the next grade based on their future leadership potential as evaluated by the board. Officers determined to have the leadership potential required for the next rank are promoted. Officers meeting a promotion board will have a PRF written by their senior rater who can make three recommendations for promotion; 1) “Definitely Promote” (DP), “Promote” (P), or “Do Not Promote This Board” (DNP). DNPs are usually reserved for officers under circumstances in which unfavorable information may exist. While a senior rater may give an unlimited number of Ps and DNPs, DPs are based on an eligible number of officers. Since the numbers of officers that a board can select for promotion are greater than the number of DP recommendations, and since a “DP” is not a guarantee of promotion, each board will select for promotion some officers who receive a “Promote” recommendation.

Two of the most significant factors for promotion are OPRs and the level of responsibility in their current and past assignments. However, level of education also plays a role, especially in promotion to grades above O3. This includes PME as well as attainment of an advanced degree. While all officers should complete PME commensurate with their grade, those possessing an advanced degree may have a distinct advantage, which is why starting in 2003, academic information was masked for selection boards for the grades of O3 and O4. However, this information is not masked for senior raters, who must recommend who should be promoted to the next higher grade. Therefore, an educational bias may exist where having an advanced degree may differentiate one officer from an equally qualified peer. It should be emphasized that advanced degrees are not masked for the grade of O5, which is a reason many “careerists” may pursue an advanced degree earlier in their careers.

#### **D. AIR FORCE GRADUATE EDUCATION OPPORTUNITIES**

The Air Force offers numerous opportunities for officers to obtain an advanced degree either in-residence or through off-duty education programs. The problem faced by some officers is fitting graduate education into an already busy career. While any officer can complete a degree, duties permitting, through off-duty education programs using tuition assistance or like programs, in-residence programs are more career-field and

grade-dependent and filled through competitive boards. As a result, many officers may complete off-duty education at the beginning of their careers, time permitting, and then pursue in-residence programs as they become more senior in rank.

In-residence programs, which are fully funded, can be broken down into the two broad categories of AAD and developmental education. The focus of AAD is to obtain a degree directly related to the primary utilization area of an officer and to enhance an officer's professional qualifications. Therefore, this type of education would be considered firm-specific and usually focuses on an officer's AFS. There are over 4,000 advanced academic degree (AAD) positions within the Air Force, which are normally completed either at AFIT, NPS, or through civilian institutions. The largest population of officers who obtain AAD degrees are company grade officers mainly from the acquisition and financial community, however opportunities exist for other career fields and grades.

Conversely, the focus of developmental education programs is generally an advanced degree that tends to enhance job performance and provides breadth development versus meeting specific qualifications. Therefore, developmental education tends to be more general in nature rather than firm-specific. Programs that fall under this category include: attendance at one of the intermediate PME schools, where often an advanced degree can be earned with additional coursework; the Air Force Intern Program where officers split time working in the Pentagon and attending classes; fellowship programs; or attendance at NPS or AFIT as a field grade officer. Field grade officers comprise the largest population of officers who attend developmental educational programs in which an advanced degree is completed; however, some opportunities are available for O3s, normally with at least six years of commissioned service.

## **E. CHAPTER SUMMARY**

This chapter has described in general terms how Air Force officers are classified, evaluated, and promoted and has provided information about graduate education opportunities. The main purpose of this chapter is to establish how graduate education is deliberately embedded into officer professional development, and to explain that there are different opportunities throughout an officer's career to complete an advanced degree either in-residence or off-duty, dependent upon career field and other decision criteria.

Further, it highlights the fact that, although performance is the major criterion for promotion, and the Air Force focuses on promoting the “best qualified”, advanced education may also be a factor, especially when personnel are perceived as otherwise equal. Similarly, graduate education can be used by officers as a signaling mechanism to indicate not only how they may have improved their productivity but also their desire to make the Air Force a career.

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## **IV. DATA AND METHODOLOGY**

This chapter describes the data set and the methodology that guides the specification of the models. It also provides descriptive statistics for each data set used to estimate the various performance models.

### **A. DATA**

The data sets used in this study are developed from the Active Duty Military Officer File for the Air Force maintained at DMDC in Monterey, CA. The file tracks active duty officers through their military careers. Specifically, the file is constructed for each fiscal year's accessions, using three types of information per individual: first accession, the individual's most recent information, and the first loss information. Personal data elements include a unique ID, education level, marital status, number of dependents, age, and race. Military data elements include pay grade, source of commission, Air Force Specialty Code, DoD Occupation Code, current months in grade, and date of current rank. The file constructed for this study contains observations of Air Force officers who were on active duty between 1992 through 2006 in the grades of O2 through O4. It was pre-determined to use only observations for officers commissioned after 1992 to minimize any force structure changes associated with the post-Cold War drawdown while still capturing several accession cycles whose members that would be retained through the rank of Major.

The original raw data file included 55,542 observations and 44 data elements before being converted into a SAS (Statistical Application Software) file for the statistical analysis. The data were then limited to just Line of the Air Force (LAF) officers (excludes medical, legal, and chaplain personnel) who attained at least a baccalaureate degree. Additionally, while it is possible to achieve a commission without a baccalaureate degree, it is unusual in the Air Force and so officers with less than a baccalaureate degree were excluded from the study.

Some observations were deleted due to missing or unknown information for the following data elements: begin paygrade, current paygrade, current AFSC, current education level, gender, current marital status, current dependents, current age, current

months in grade, or begin years of service. Further, the data were restricted to officers who had not separated in grades below O3 or who were currently not an O3 or O4. This resulted in 28,505 observations available for modeling using the data elements listed in Table 6 below.

Table 6. Data File Elements Utilized for USAF Officers

Gender
Race
Begin Years of Service
Current Age
Current Marital
Current Education Level
Current Dependent Count
Current Source of Entry Code
Current Paygrade
Current Months in Grade
Current AFSC
Current DOD Occupation Code
Current Date Current Rank
Separation Paygrade
Separation Transaction Code
Interservice Separation Code

Source: DMDC

Given that the objective of this study is to model the effects of graduate education on retention and promotion behavior, the data were categorized into the two groups, Captains and Majors, for retention and promotion analysis. These two ranks were selected because they represent major decision points in an officer's career. Further, from an Air Force perspective, these two ranks represent "middle management" and are considered the backbone of the officer corps. To examine retention behavior, two models were constructed, one for each rank. Only one model was estimated to explain promotion. This model addressed promotion to the rank of Major, since promotion to the rank of Captain is almost 100 percent.

A single database was constructed to use in determining the probability of staying in the Air Force and the probability of being promoted. Observations were first identified as those voluntarily separating ("leavers") and those selecting to stay ("stayers"). "Stayers" include those who voluntarily stay in the Air Force beyond their initial



commitment and “leavers” include those who voluntarily leave after completing their initial commitment. The purpose of separating involuntary leavers from voluntary leavers is to model voluntary retention and promotion behavior more accurately. Individuals who leave due to poor health, retirement, who die, or for whom the reason for separation was unknown were excluded from the study (533 observations). Individuals who were involuntary separated for discipline problems were also excluded from the study (466 observations). For the promotion model, the data used for analysis were the “stayers” identified from the retention model who were eligible for promotion to major, 6,581 observations.

As a result, a total of 27,506 observations remained for analysis. The number of voluntary leavers and stayers for the grades being studied are provided in Table 7 below.

Table 7. Number of Observations

<b>Current Rank (Grade)</b>	<b>Leavers</b>	<b>Stayers</b>	<b>Total</b>
Captain (O3)	3,802	16,923	20,725
Major (O4)	233	6,548	6,781
Total Observations	4,035	23,471	27,971

Source: Author

## **B. PRELIMINARY DATA ANALYSIS**

### **1. Dependent and Explanatory Variables**

#### ***a. Dependent Variables***

The dependent variable used for the retention model is constructed using the InterService Separation Codes provided by DMDC, which show if an officer separated, separation rank, and the rationale for the loss. The dependent variable for retention is based on these codes. A voluntary separation or release from the Air Force is categorized as STAY = 0, otherwise STAY = 1. The separation codes for leavers, reason for separation, and number of observations are shown in Table 8.

Table 8. Voluntary Separation Codes for Leavers

DMDC Code	Description	Frequency	Percentage (%)
2001	Expiration of term of service	3,220	79.80
2002	Voluntary release, to attend school or to teach	6	0.15
2003	Voluntary release, in the national interest	0	0
2005	Voluntary release, other, including VSI and SSB	809	20.05
Total		4,035	100

Note: These codes can be found in DMDC Active Duty Military Edit File  
Source: Author

The dependent variable used for the promotion model is initially based on the data from the retention model where STAY = 1 and then promotion outcomes were then constructed using InterService Separation Codes provided by DMDC, which indicated if an officer was separated for failure of selection for promotion. If there was no Interservice Separation Code, then promotion was determined by comparing the beginning rank information with the individual's most recent rank to determine if they were promoted to O4, and the dependent variable is coded as PROMOTE =1. Conversely, if there was an Interservice Separation Code indicating that an officer failed to be promoted, then the dependent variable is coded as PROMOTE = 0.

***b. Explanatory Variables***

The explanatory variables include officers' personal characteristics and professional backgrounds. They are grouped into the following categories: Demographics, Professional, and Education. Demographics consist of gender, race, age, marital status, and number of dependents. Professional factors were commission source, current months in grade, prior enlisted experience, and AFSC career group. Education consists of the highest level of education e.g., baccalaureate or master's and above.

## 2. Data Description for Stayers and Leavers

Table 9 provides statistics about the two ranks being studied for the retention model. It provides an overview of the characteristics of LAF officers in the grades of O3 and O4. These data are used to provide an understanding of the dynamics of the samples and help formulate hypotheses about the effects of the explanatory variables on LAF retention at the two grades of O3 and O4.

Table 9. Descriptive Statistics of LAF Officers  
(percent or mean)

	<b>Captain</b> N=20728	<b>Major</b> N=6782
<b>Retention%</b>		
Stay	81.66	96.56
<b>Gender%</b>		
Male	83.01	89.88
Female	16.99	10.12
<b>Race%</b>		
White	80.75	85.84
Black	6.91	5.50
Other Race	12.34	8.66
<b>Current Age (Mean)</b>		
Current Age (Yrs)	30.82	35.71
<b>Marital Status %</b>		
Married	70.46	85.78
Not Married	29.54	14.22
<b>Dependents %</b>		
One Dependent or Less	56.75	29.64
Two Dependents or More	72.25	88.35
<b>Commission Source%</b>		
Air Force Academy	24.39	22.25
ROTC	44.66	54.81
OTS & Other Sources	30.96	22.93
<b>Career Field%</b>		
Operations (Ops)	50.31	53.90
Logistics (Log)	9.02	8.55
Support (Spt)	22.08	21.06
Acquisition & Financial Mgt (AQF)	17.27	16.02
Special Duty (SD)	1.32	0.47
<b>Prior Enlisted Experience%</b>		
Prior Enlisted Experience	24.52	21.49
No Prior Enlisted Experience	75.48	78.51

	<b>Captain</b> N=20728	<b>Major</b> N=6782
<b>Current Months in Grade (Mean)</b>		
Current Months in Grade	28.72	19.28
<b>Current Education%</b>		
Baccalaureate Degree	73.57	31.94
Master's Degree or Above	26.43	68.06

Source: Author

The demographics of each grade differ slightly, which is not unexpected given that the promotion points differ by roughly six years. Immediately, it can be seen that the proportion who voluntarily separate is larger for O3 officers than for O4 officers, 18 and 3 percent, respectively. This is in part driven by officers fulfilling the term of service and wishing to pursue other opportunities at the O3 point. Further, the O3 separation rate may be influenced by dissatisfaction with military life or possibly poor job-match. Moreover, an officer staying to the grade of O4 may be inclined to make the Air Force a career, but may also be influenced by the risk aversion associated with searching for a new career.

The demographics indicate that there are slight differences between the grades, with white, married males comprising the majority of the LAF population. One notable difference is the larger percent of married officers and officers with dependents among those at the O4 grade. This can be explained in part by the decision to start a family as one matures. The average age of Captains is 30.82 years and for Majors it is 35.71 years.

The professional factors show that the majority of commissioned officers at the rank of Captains are accessed through ROTC, followed by OTS and other sources, and then the AFA at 44.66, 30.96, and 24.39, percent respectively. For the rank of Major, the commissioning source shows similar composition at 54.81, 22.93, and 22.25 percent. Career fields see some small differences between grades with operations and support officers comprising the largest career fields for both. The statistics show personnel with prior enlisted experience comprise 24.52 percent of the Captain population and 21.49 of the Major population.

The one notable change between the grades is the level of education, with Majors possessing a higher percentage of advanced degrees. Officers holding a baccalaureate degree comprise 73.57 percent of the Captain population but only 31.94 percent of the Major population.

Tables 10 and 11 provide information about how the characteristics of LAF officers are related to the decision to either voluntarily separate or stay in the Air Force. These tables show how retention rates vary by the explanatory variables for each grade.

Table 10. Distribution of Captain “Leavers” and “Stayers” by Background Characteristics  
(percent and mean)

	<b>Captain “Leavers”</b> N = 3802	<b>Captain “Stayers”</b> N=16923
<b>Gender%***</b>		
Male	16.51	83.49
Female	27.29	72.71
<b>Race%*</b>		
White	18.70	81.30
Black	16.41	83.59
Other Race	17.13	82.87
<b>Current Age (Mean)+</b>		
Current Age (Yrs)	29.14	31.19
<b>Marital Status %***</b>		
Married	15.63	84.37
Not Married	24.81	75.19
<b>Dependents %***</b>		
One Dependent or Less	22.82	77.18
Two Dependents or More	14.85	85.15
<b>Commission Source%***</b>		
Air Force Academy	21.49	78.15
ROTC	20.09	79.91
OTS & Other Sources	13.36	86.64
<b>Career Field%</b>		
Operations (Ops)	12.61	87.39
Logistics (Log)	18.72	81.28
Support (Spt)	24.93	75.07
Acquisition & Financial Mgt (AQF)	26.32	73.68
Special Duty (SD)	19.78	80.22
<b>Prior Enlisted Experience%***</b>		
Prior Enlisted Experience	6.16	93.84

	<b>Captain “Leavers”</b> N = 3802	<b>Captain “Stayers”</b> N=16923
No Prior Enlisted Experience	22.30	77.70
<b>Current Months in Grade (Mean)+</b>		
Current Months in Grade	26.90	29.12
<b>Current Education%***</b>		
Baccalaureate Degree	18.89	81.11
Master’s Degree or Above	16.82	83.18

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

+ T-statistic for difference in means significant at .01 level

Source: Author

Table 11. Distribution of Major “Leavers” and “Stayers” by Background Characteristics  
(percent and mean)

	<b>Major “Leavers”</b> N = 233	<b>Major “Stayers”</b> N=6548
<b>Gender%***</b>		
Male	3.18	96.82
Female	5.69	94.31
<b>Race%</b>		
White	3.52	96.48
Black	1.61	98.39
Other Race	3.75	96.25
<b>Current Age (Mean)+</b>		
Current Age (Yrs)	33.85	35.77
<b>Marital Status %***</b>		
Married	3.15	96.85
Not Married	5.19	94.81
<b>Dependents %**</b>		
One Dependent or Less	4.88	95.12
Two Dependents or More	3.24	96.76
<b>Commission Source%***</b>		
Air Force Academy	6.96	93.04
ROTC	2.80	97.20
OTS & Other Sources	1.54	98.46
<b>Career Field%</b>		
Operations (Ops)	4.79	95.21
Logistics (Log)	1.72	98.28
Support (Spt)	2.03	97.97
Acquisition & Financial Mgt (AQF)	1.66	98.34
Special Duty (SD)	3.12	96.88
<b>Prior Enlisted Experience%***</b>		

	<b>Major “Leavers”</b> N = 233	<b>Major “Stayers”</b> N=6548
Prior Enlisted Experience	0.62	99.38
No Prior Enlisted Experience	4.21	95.79
<b>Current Months in Grade (Mean)+</b>		
Current Months in Grade	12.28	19.53
<b>Current Education%***</b>		
Baccalaureate Degree	5.59	94.41
Master’s Degree or Above	2.43	97.57

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

+ T-statistic for difference in means significant at .01 level

Source: Author

Table 11 indicates that, for the rank of Captain, a larger percentage of males stay in the Air Force at 83.49 percent as compared to females at 72.71 percent. For the rank of Major, the difference in separation percentage by gender is not as pronounced, being 96.82 for males and 94.31 for females. Of interest is how the percentage of females deciding to stay increases between grades. This change could be in part be explained by some females opting to separate in order to raise a family or pursue civilian opportunities at the end of their initial commitment, with the others deciding to make the Air Force a career. The similar retention rates for men and women at the O4 level may indicate that there is no “glass ceiling” perceived by females at the rank of Major and that they perceive the same opportunities as their male counterparts. With respect to race, while whites makes up the majority of the officer population, minorities have slightly better retention rates at the rank of Captain. Similarly, at the rank of Major, blacks have the highest retention rate, 98.39 percent, followed closely by Whites, 96.48 percent, and others, 96.25. This could be a result of minorities preferring the military lifestyle to comparable civilian opportunities, which might be reinforced in part, by the equal employment opportunities afforded in DoD. Current age shows that Captains, on average, decide to separate at age 29 and Majors at almost 34, which is approximately two years sooner than the stayers. Marital status shows that married personnel make up the largest percentage of the population, but are less likely to separate at 84.37 versus 5.63 percent and 96.85 versus 3.15 percent for O3s and O4s, respectively, as compared to officers who are not married. Captains with two or more dependents are also more likely

to stay in the Air Force at 85.15 percent, as compared to their peers who have one dependent or less at 77.18 percent. Retention improves substantially at the rank of Major, regardless of the number of dependents, with both groups having retention rates over 95 percent. Both marital status and the number of dependents indicate that these factors may have more influence on retention behavior at the grade of Captain as compared to the grade of Major.

Professional factors show that officers who received their commission through OTS and other sources have the highest retention rate in the Captain sample at 86.64 percent, followed by ROTC at 79.91 percent, and the AFA at 78.51. Similarly, for Majors, officers commissioned through OTS have the best retention rate, but all sources are above 93 percent. While the initial commitments for these groups are the same, four years, any differences between the groups might be explained by taste for military lifestyle, with OTS graduates possibly having a higher satisfaction with military life based on previous experience since a majority of this population is prior enlisted. Surprisingly, AFA graduates had the lowest retention rates. Regarding career fields, the best retention rate at Captain is in for operations at 87.39 percent; however, this career field also makes up the largest percentage of officers. The other career fields see the largest exodus at the rank of Captain with those in the Support and Acquisition & Financial Management suffering the most retention problems at 24.93 and 26.32 percent respectively. This may in part be due to available civilian opportunities for AFSs who have a direct civilian equivalent occupation. At the rank of Major, all career fields have a retention percentage above 95 percent, with those in operations having the highest separation percentage at 4.79 percent. The majority of officers do not have prior duty experience (see Tables 10 and 11), but those that do have a higher retention rate than those who do not. Current months in grade for Captains indicate that those selecting to separate do so at almost the 27-month point, which indicates that they stayed in the Air Force over two years longer than their initial 4-year commitment, but about a month less than the general Captain population. This indicates that an additional commitment was probably incurred above either the initial commitment of four years or the presence of other influences that initially made them stay on active duty, which in turn may have lost



their effect on remaining on active duty. For the rank of Major, current months in grade was around 12 for those separating, which indicates that, on average, separating officers only stayed six months longer than the required 6 months after pin-on.

Regarding education, the primary focus of this research, Table 10 indicates that only 81.11 percent of Captains who possess only a baccalaureate degree are retained, while Captains possessing more advanced levels of education stay at a higher rate, 83.18 percent. The relationship of education level and retention changes substantially at the rank of Major, especially among those officers possessing an advanced degree (see Table 11). Over 3 percentage points separate the retention rates for Majors holding an advanced degree and those who do not. This may indicate that the possession of an advanced degree can serve as a retention tool, possibly due in part to an additional incurred service and perhaps their firm-specific education residing in DoD. Normally, an additional commitment of two years is required for individuals using tuition-assistance with those attending in-residence program owing three years. Given the additional time commitment, some officers who were undecided about their future, may elect to become stayers. Further, the literature review indicated that employees with firm-specific training have less incentive to leave a firm since their particular skills may only exist in certain fields or industries.

Table 12 displays a cross tabulation that shows the combined distribution, in percentages, of education level and career field by the decision to “stay” or “leave.” Of particular note, Table 12 highlights that certain career fields may have more advanced education requirements and, in turn, greater opportunities to attend in-residence programs or at least place greater emphasis on obtaining an advanced degree. Additionally, it shows that officers in the acquisition and financial management (AQF) have the highest levels of education, by percentage, among those choosing to stay as well as leave.

Table 13 provides further analysis on education level by career field. The results indicate that at the rank of Captain, AQF officers possess the highest level of education with officers possessing a master’s degree or higher comprising 46.27 percent of the career field. The other career fields have the following percentages of officers possessing an advanced degree: support (33.62 percent); logistics (29.84 percent); operations (16.07

percent); and special duty (17.95 percent). The composition nearly doubles for each career field at the rank of Major, where the majority of officers possess an advanced degree. The breakout for each career field, from largest to smallest, is the following: AQF (88.49 percent); special duty (87.50 percent); support (76.75 percent); logistics (75.86 percent); and operations (57.18 percent). This trend change indicates that as officers assume more managerial positions as they rise in rank, that acquiring a degree may be more beneficial, but also that opportunities may be more prevalent to obtain an advanced degree.

Table 12. Education Level by Career Field for LAF Officer Retention Behavior

Current Education %	Stay					Leave				
	Ops	Log	Spt	AQF	SD	Ops	Log	Spt	AQF	SD
Baccalaureate Degree	72.47	56.51	51.33	38.91	73.60	79.93	75.28	75.98	63.23	80.0
Master's Degree or Above	27.53	43.49	48.67	61.09	26.40	20.07	24.72	24.02	36.77	20.0
Total	100	100	100	100	100	100	100	100	100	100
Columns may not add to total due to rounding. Source: Author										

Table 13. Education Level by Career Field for LAF Officers

Current Education %	Captain					Major				
	Ops	Log	Spt	AQF	SD	Ops	Log	Spt	AQF	SD
Baccalaureate Degree	83.93	70.16	66.38	53.73	82.05	42.82	24.14	23.25	11.51	12.50
Master's Degree or Above	16.07	29.84	33.62	46.27	17.95	57.18	75.86	76.75	88.49	87.50
Total	100	100	100	100	100	100	100	100	100	100
Columns may not add to total due to rounding. Source: Author										

In summary, there are several differences between those who choose to stay and those selecting to separate in the focus areas. Regarding voluntary retention separation behavior, the largest exodus occurs at the rank of Captain with a significant decline in departures occurring at the Major. LAF officers choosing to be retained early in their careers as Captains are more likely to be married males, who have two dependents or more, but there is no large difference regarding race. Professional factors indicate this group is more likely to be commissioned through OTS and work in the operations career. Education factors indicate that they are more likely to separate if they only possess a baccalaureate degree. The demographics for Majors deciding to be retained are not different from those who leave at the rank of Captain, with one major difference being that females are about as likely as males to be retained. One noteworthy demographic for the Major population, is that the average separation age is almost 34, whereas for those choosing to stay in the Air Force the average age is almost 36. Professional factors indicate that operations personnel and AFA graduates are more likely to separate at the rank of Major; however, overall there is not much variation between career fields or source of commission. While ROTC and OTS graduates have a slightly higher retention rate, than those from the AFA, all three sources have a retention rate above 93 percent. Similarly, there is little difference in retention behavior between career fields, with retention rates all being above 95 percent. The information about education level shows that officers holding an advanced degree are more likely to be retained among both Captains and Majors. Figure 2 shows education levels by grade for those voluntarily separating and being retained.

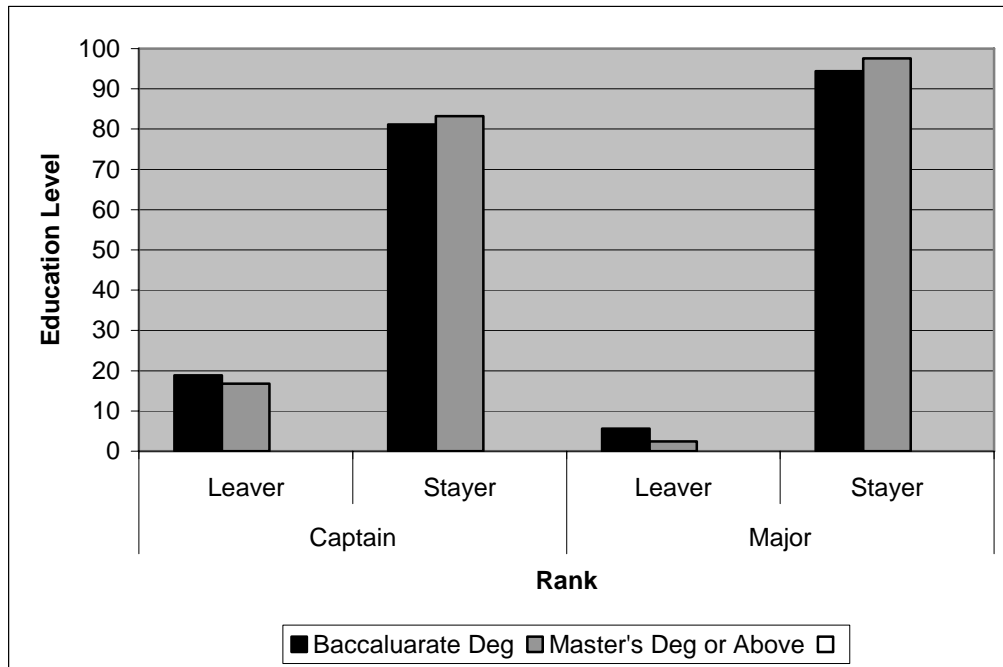


Figure 2. Education Level by Retention Decision  
Source: Author

### 3. Data Description for Retention and Promotion

Table 14 provides statistics about the sample used for the analysis of promotion. These officers are those among the target group of Captains (O3) in the retention sample who were retained (“stayers”) and who were eligible to be promoted or not promoted to the next grade of Major. Due to time-in-grade requirements, of the 16,923 officers that were retained in the Air Force, only 6,781 are promotion eligible. Frequency distributions and cross tabulations were used to describe the dependent and explanatory variables, first as a total sample encompassing all year groups and also by looking at the year groups of 1993 and 1994 independently and as a pooled sample, specifically to examine the effects due to an education policy change in 2003. This allows for some comparisons between the overall sample and the two years of particular interest.

Officers eligible for promotion during this time were commissioned between 1992 and 1997. Those commissioned in 1997 were excluded, since the data were incomplete and may not have completely captured any pending promotions. Therefore, 200 observations were excluded from the overall sample leaving the total observations at

6,581. The data in Table 13 are shown as either a percentage of the sample or an overall mean. These data are used to provide an understanding of the dynamics of the sample and help formulate hypotheses of the effects of the explanatory variables on retention and subsequent promotion behavior of the group.

Table 14. Characteristics of LAF Officers Eligible for Promotion  
(percent or mean)

	<b>Total Sample N=6581</b>	<b>93 Cohort N=1782</b>	<b>94 Cohort N=1894</b>	<b>Pooled Sample (93-94) N=3676</b>
<b>Promotion%</b>				
Promote	98.54	99.72	97.84	98.75
<b>Gender%</b>				
Male	89.86	90.68	90.81	90.77
Female	10.14	9.32	9.19	9.25
<b>Race%</b>				
White	85.56	85.69	87.49	86.62
Black	5.67	4.04	5.39	4.73
Other Race	8.77	10.27	7.13	8.65
<b>Current Age (Mean)</b>				
Current Age (Yrs)	35.71	35.89	35.27	35.57
<b>Marital Status %</b>				
Married	85.55	86.81	85.69	86.24
Not Married	14.45	13.19	14.31	13.76
<b>Dependents %</b>				
One Dependent or Less	29.77	28.28	31.47	29.92
Two Dependents or More	88.18	89.39	88.23	88.79
<b>Commission Source%</b>				
Air Force Academy	22.84	29.80	27.61	28.67
ROTC	55.51	49.83	46.25	47.99
OTS & Other Sources	21.65	20.37	26.14	23.34
<b>Career Field%</b>				
Operations (Ops)	53.29	52.27	51.85	52.07
Logistics (Log)	8.57	9.76	9.35	9.55
Support (Spt)	21.44	23.28	22.86	23.04
Acquisition & Financial Mgt (AQF)	16.26	14.41	15.58	15.01
Special Duty (SD)	0.44	0.28	0.36	0.33
<b>Prior Enlisted Experience%</b>				
Prior enlisted experience	20.70	19.92	19.59	19.75
No prior enlisted experience	79.30	80.08	80.41	80.25
<b>Current Education%</b>				
Baccalaureate Degree	31.48	28.45	37.06	32.89
Master's Degree or Above	68.52	71.55	62.94	67.11

Source: Author

The preliminary analysis in Table 14 summarizes the characteristics of LAF officers who are retained in the Air Force and subsequently become promotion eligible to the rank of Major. The total sample shows that over 98 percent of those eligible for promotion were promoted to Major.

The demographics vary slightly from year to year, but overall, males comprise the majority (over 90 percent) of the pooled sample. Similarly, whites make up the preponderance of the pooled group at 86.62 percent with blacks, and other races comprising the difference of 4.73 and 8.65 percent, respectively. While there is some greater variation between races in the year groups 1993 and 1994, it is very small. Likewise, there is no significant changes in the current age of the population with the overall sample age mean being over 35.71 years of age. Marital status remains stable with the majority of the officers in the pooled sample being married at 86.24 percent. Dependent status also remains steady with officers having more than two dependents making up the bulk of the pooled sample at 88.79. This may be the result of married officers with several dependents enjoying the security and quality of life an Air Force career provides, but may also just represent the population as a whole that decides to make the military a career.

The professional factors display some minor changes between years, but remain consistent. The accession source shows that graduates from the AFA make up 28.67 percent, ROTC 47.99 percent, and OTS and other sources the remaining 23.34 percent of the pooled sample. Of particular note, OTS graduates show over 5 percentage points growth between the 1993 and 1994 groups, but overall there is little difference in accession sources. Similarly, there are some small variations between the two time periods in career fields and prior enlisted experience, but over all, there are no significant variations. The majority of officers in the pooled sample, 80.25 percent, have no prior enlisted experience. Operations remains the largest career field represented comprising 52.07 percent of the pooled sample, followed by the other career fields of support, acquisition and financial management, logistics, and special duty at 23.04, 15.01, 9.55, and 0.33 percent, respectively.

The area of education shows the most dramatic change. While not obvious in looking at the pooled sample, in examining the 1993 and 1994 cohort data it can be seen that there is distinct change in officer education levels, which in large part may be explained by the change in Air Force policy that occurred during this time period. Under the new policy, education levels were masked when officers were evaluated for promotion, effective in 2003. Thus, the 1994 cohort was affected by this policy change while the 1993 cohort was not. In the 1993 cohort, 28.45 percent of the officers possessed only a baccalaureate degree. This increased to 37.06 percent in the 1994, a change of over 8 percent, matched by a drop of 8 percent in advanced education between these two years. This indicates that the change in Air Force policy may have had a negative effect on officers pursuing advanced education. While the overall level of advanced degrees for the pooled sample is quite high at 68.52 percent, indicating that some career officers may decide to forgo advanced education in the near term while others still place a high value on it.

Table 15 shows the relationship of the characteristics of LAF officers to promotion for the pooled sample. Table 16 provides the same information for the two commissioning year cohorts. This data combined with the information from Table 14 provides useful information to help identify any differences between those officers that are retained and subsequently promoted and those officers who are passed over.

Table 15. Characteristics of LAF Officers By Promotion Status, Pooled Sample  
(percent or mean)

	<b>Not Promoted</b> N=46	<b>Promoted</b> N=3630
<b>Gender%</b>		
Male	1.17	98.83
Female	2.06	97.94
<b>Race%**</b>		
White	1.16	98.84
Black	2.87	97.13
Other Race	1.26	98.74
<b>Current Age (Mean)+</b>	34.70	35.58
Current Age (Yrs)	34.62	35.73
<b>Marital Status %***</b>		
Married	0.95	99.05
Not Married	3.16	96.84
<b>Dependents %***</b>		
One Dependent or Less	1.82	98.18
Two Dependents or More	1.04	98.96
<b>Commission Source%</b>		
Air Force Academy	0.66	99.34
ROTC	1.53	98.47
OTS & Other Sources	1.40	98.60
<b>Career Field%</b>		
Operations (Ops)	0.78	99.22
Logistics (Log)	0.57	99.43
Support (Spt)	2.60	97.40
Acquisition & Financial Mgt (AQF)	1.27	98.73
Special Duty (SD)	0.0	100
<b>Prior Enlisted Experience%</b>		
Prior enlisted experience	1.10	98.90
No prior enlisted experience	1.29	98.71
<b>Current Education%***</b>		
Baccalaureate Degree	2.32	97.68
Master's Degree or Above	0.73	99.27

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

+ T-statistic for difference in means significant at .01 level

Source: Author



Table 16. Characteristics of LAF Officers Promoted and Not Promoted- 93/94 Cohort  
(percent or mean)

	<b>1993 Cohort</b>		<b>1994 Cohort</b>	
	<b>Not Promoted</b> N=5	<b>Promoted</b> N=1777	<b>Not Promoted</b> N=41	<b>Promoted</b> N=1843
<b>Gender%</b>				
Male	0.31	99.69	1.98*	98.02*
Female	0	100	4.02*	95.98*
<b>Race%</b>				
White	0.26	99.74	1.99	98.01
Black	0	100	4.90	95.10
Other Race	.55	99.45	2.22	97.78
<b>Current Age (Mean)</b>				
Current Age (Yrs)	35.2+	35.88+	34.63+	35.28+
<b>Marital Status %</b>				
Married	0.19*	99.81*	1.66***	98.34***
Not Married	0.85*	99.15*	5.17***	94.83***
<b>Dependents %</b>				
One Dependent or Less	0.40**	99.60**	3.02**	96.98**
Two Dependents or More	0.19**	99.81**	1.86**	98.14**
<b>Commission Source%</b>				
Air Force Academy	0.38	99.62	1.32*	98.68*
ROTC	0.23	99.77	1.13*	98.87*
OTS	0.28	99.72	4.85*	95.15*
<b>Career Field%</b>				
Operations (Ops)	0.21	99.79	1.32	98.68
Logistics (Log)	0	100	1.13	98.87
Support (Spt)	0.24	99.76	4.85	95.15
Acquisition & Financial Mgt (AQF)	0.78	99.22	1.69	98.31
Special Duty (SD)	0	100	0	100
<b>Prior Enlisted Experience%</b>				
Prior enlisted experience	0.28	99.72	1.89	98.11
No prior enlisted experience	0.28	99.72	2.23	97.77
<b>Current Education%</b>				
Baccalaureate Degree	0.59	99.41	3.56***	96.44***
Master's Degree or Above	0.16	99.84	1.34***	98.66***

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

+ T-statistic for difference in means significant at .01 level

Source: Author

In examining the pooled sample, the demographics indicate that males are more likely to be promoted to Major at 98.83 percent, as compared to females who were promoted at 97.94 percent. The Race distribution in Table 15 indicates that overall whites are promoted at the highest rate, but there is no clear distinction between races indicating that they are promoted at a rate that is no different from the population. Marital and dependent status shows that married officers with two or more dependents are more likely to be promoted than those are not married with one or less dependents, but there is very little variation between these factors.

Professional factors show that AFA graduates have the highest selection rate at 99.34 percent and ROTC the lowest at 98.47 percent. Regarding career fields, those in logistics have the best promotion rates at 99.43 percent with those in support the worst at 97.40 percent. Further, those with prior enlisted experience are promoted at 0.19 percentage points higher than those who do not have prior enlisted experience.

Regarding education, the statistics indicate there is very little difference in promotion rates based on education. Officers possessing an advanced degree were promoted 1.59 percentage points higher than those who possess just a baccalaureate degree.

In looking at the two specific years, the demographics indicate that there are only small differences between the two cohorts. Of interest in the 1993 group, females and blacks were promoted at 100 percent. Additionally, age indicates that the 1993 group was slightly older than the 1994 group. Professional factors denote that there are no significant differences between the commissioning sources and career fields, with logistics personnel having the best promotion rate for each year group. Prior enlisted experience indicates that those with prior duty promote at the same or higher rate than those without prior experience. Education shows that officers with an advanced degree are promoted at a higher rate regardless of the year, but of interest is the change in overall education between years. In 1993, it appears that the overall level of education was higher than compared to 1994.

In summary, there were no major differences in demographics and professional factors, which is to be expected given that the promotion is based being the “best qualified.” While there are some small differences in education levels on those promoted, it was less than 2 percentage points for the overall sample. Figure 3 shows the level of education effect on promotion.

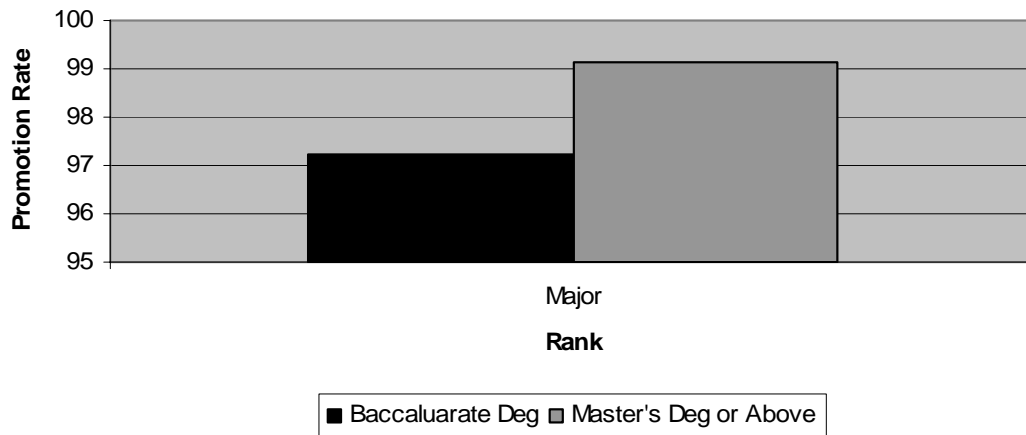


Figure 3. Promotion Rate and Education Level  
Source: Author

## C. METHODOLOGY

The purpose of this thesis is to investigate the relationship between graduate education and the performance of LAF officers. Since it is difficult to measure the job performance of officers, some proxy measures must be used to measure differences in officer performance. Two measures that can be used to evaluate this performance are promotion and retention behavior, according to human capital theory.

### 1. Theoretical Model

Logistic regression models can be used to explain the decision to leave the Air Force rather than voluntarily staying, as well as the event of being promoted. This modeling technique provides a framework to describe the relationship between a binary outcome (dependent) variable and a set of independent (explanatory) variables. This technique is commonly used when the dependent variable is binary, (1 = STAY and 0 =

LEAVE or, conversely, 1 = PROMOTE and 0 = NOT PROMOTE). The logit model is associated with the cumulative logistic probability function where P is the probability of leaving/promoting and X is a set of explanatory variables. The form of the general equation may be written as follows:

$$L_i = \ln [P_i / (1 - P_i)] = \alpha + \beta x_i$$

where:

$L_i$  = The log of the odds ratio

$P_i$  = The probability an individual stays given personal attributes  $x_i$

$\alpha$  = The intercept parameter

$\beta$  = The direction (vector) of the slope of explanatory variable coefficients

$x_i$  = Values of explanatory variables in the model

For examining retention, the two models are estimated, one for O3s and one for O4s, using a maximum likelihood technique. To examine promotion to Major, the maximum likelihood technique will also be used to determine why some officers are promoted and some are not. A difference-in-difference estimator is included in the promotion model. The difference-in-difference estimator is used to determine if the effect of advanced education on promotion is different after the change in education policy in 2003. In 2003, the Air Force began masking educational records as a means to decrease the perception that advanced education was required for promotion to the rank of Major. Cohort 1994 roughly corresponds to the policy change. The treatment group will be those with advanced education, a master's degree or higher. The control group will be those who only possess a baccalaureate degree. Overall, the effect being measured by the differencing estimator is whether there was a change in the effect of graduate education on promotion associated with the change in policy between the two periods.

The signs of the individual coefficients will indicate whether an explanatory variable is associated with either increasing or decreasing the probability of retention and subsequent promotion. A positive sign for a parameter estimate indicates an increase in the probability of staying in the case of retention and an increase in the probability of promotion for the promotion model.

## 2. Logit Model

Listed below are the models used in the analysis as well as a list of the explanatory variables. A full description of variables and their expected effects are discussed in Section 3 of this chapter.

### *a. Retention Models for Captain and Major*

$$L_i = \ln [P_i / (1 - P_i)] = \beta_0 + \beta_1(\text{Female}) + \beta_2(\text{Black}) + \beta_3(\text{Other}) + \beta_4(\text{NotMar}) + \beta_5(\text{OneDep}) + \beta_6(\text{Age}) + \beta_7(\text{AFA}) + \beta_8(\text{OTS}) + \beta_9(\text{Log}) + \beta_{10}(\text{Spt}) + \beta_{11}(\text{AQFM}) + \beta_{12}(\text{SD}) + \beta_{13}(\text{PE}) + \beta_{14}(\text{MIG}) + \beta_{15}(\text{MA})$$

where:

Female = Gender is female

Black = Race is Black/African American

Other = Other race is other than White or Black/African American

NotMar = Not Married

OneDep = One or no dependents

Age = Current Age (Mean)

AFA = Commissioned through the Air Force Academy (AFA)

OTS = Commissioned through Officer Training School (OTS) or other source

Log = Career field is logistics

Spt = Career field is support

AQFM = Career field is acquisition and financial management

SD = Career field is special duty

PE = Prior enlisted experience

MIG = Months in Grade (Mean)

MA = Current education is a master's degree or above

***b. Promotion Model for Major***

$$Li = \ln [Pi/(1 - Pi)] = \beta_0 + \beta_1(\text{Female}) + \beta_2(\text{Black}) + \beta_3(\text{Other}) + \beta_4(\text{NotMar}) + \beta_5(\text{OneDep}) + \beta_6(\text{Age}) + \beta_7(\text{AFA}) + \beta_8(\text{OTS}) + \beta_9(\text{Log}) + \beta_{10}(\text{Spt}) + \beta_{11}(\text{AQFM}) + \beta_{12}(\text{SD}) + \beta_{13}(\text{PE}) + \beta_{14}(\text{FY04}) + \beta_{15}(\text{BA}) + \beta_{16}(\text{FY04\_BA})$$

where:

MA = Current education is master's degree or above

FY04 = Time trend common to control and treatment groups

FY04\_MA = Effect of treatment (education) post 2003

**3. Variables**

***a. Dependent Variables***

The dependent variable used for the retention model is constructed using the InterService Separation Codes from DMDC, which shows if an officer separated, the separation rank, and the rationale for the loss. The dependent variable for retention is based on these codes. Specifically, the codes indicating a voluntary separation or release from the Air Force are categorized as STAY = 1, otherwise STAY = 0. These codes and the number of observations are shown in Table 8.

The dependent variable used for the promotion model is initially based on data from the retention model where STAY = 1 and then promotion outcomes are determined by comparing the beginning rank information with the individual's most recent rank after excluding any individuals who are not promotion eligible. If an officer is promoted to Major, the dependent variable is coded as PROMOTE = 1. If the individual was not promoted then PROMOTE = 0.

***b. Independent Variables***

Independent variables are the explanatory factors referring to officers' personal characteristics and professional backgrounds. They are grouped into the following categories: Demographics, Professional, and Education. Demographics consist

of gender, race, marital status, number of dependents, and age. Professional factors were commission source, AFSC career groups, prior enlisted experience, and current years of months in grade. Education consists of the level of education attained. Each of the independent variables is described below. Table 14 provides a summary of the distributions for these variables:

(1) Demographics. Gender (Male, Female). The gender variable is a dichotomous variable. The base case in the models is male as they make up a majority of the officer corps. Females are represented in all of the AFSC career fields; however, there are several AFSCs within the Operations career field that are restricted to males in the special operations area. Factors that may influence negative effects for females include the cultural norm that they are the primary caregivers for families so they may opt to separate more readily than males in order to raise a family, a male-dominated work environment, and historically lower promotion rates. However, these negative effects may be offset by the trends in increased female recruiting and expanded job opportunities which allow women to pursue an Air Force career. The effect of the Female variable therefore is expected to be negative for retention but positive for promotion as compared to the base case.

Race (White, Black, Other). Race is a dichotomous variable with three categories. The base case is white since whites comprise the majority of the sample. The category of Other includes the race/ethnic groups of Asian, Pacific Islander/Native Hawaiian, Native American (American Indian/Alaska Native), and personnel of mixed descent, along with observations that are unknown. Overall, the military is perceived to provide equal employment opportunities and therefore professional and advancement opportunities for minorities are likely to be perceived as generally better when compared to the civilian sector. As a result, the effects of the Black and Other race variables are expected to be positive in relation to the base case.

Marital Status (Mar, NotMar). The marital status variable is dichotomous with Married (Mar) as the base case, as it represents a majority of the sample. The variable Not Married (NotMar) identifies personnel who have never been married or personnel who are divorced, legally separated, or widowed. Given that

married individuals have a spouse, it is assumed that they are more likely to stay in the Air Force because of financial and job stability concerns as compared to someone who is Not Married. However, this could be offset to some degree by the military lifestyle and its possible negative effects on spouse satisfaction. Conversely, it may be easier for an individual who is Not Married to transition to the civilian job market since he/she may not have the same financial and job security concerns. Using this information and the preliminary analysis, it is expected the effects of Not Married will be negative in comparison to the base case.

Dependents (OneDep, TwoDep). The dependent variable is dichotomous with 2 or More Dependents (TwoDep) as the base case since this group captures the majority of the sample. One dependent or less (OneDep) will primarily capture the sample members who are single, and those who are married but do not have children. Those with one or less dependents will have fewer familial and financial responsibilities as compared to the base case. This will allow this group to focus more on career choices which might include transitioning to civilian employment or pursuing a career in the Air Force. Therefore, the overall the expected sign of 1 Or Less Dependents is uncertain.

Current Age (Age). The Age variable is the current average age of an individual when the data was captured by DMDC as of 2006. This variable is continuous and is measured in years. As an individual grows older, his or her years of service increase, thus increasing his or her pay and benefits. Increased age may also decrease the attractiveness of career change. For these reasons, the Age variable is expected to have a positive effect.

(2) Professional. Source of Commission (AFA, ROTC, OTS). The source of commission is represented by a set of dichotomous variables. Possible accession source are through the Air Force Academy (AFA), Air Force Reserve Officers Training Corps (ROTC), or through Officer Training School (OTS). The variable OTS also includes officers who received their commission through alternative sources such as the Air National Guard Academy of Military Sciences, the Aviation Cadet Program, direct appointment authority, or receiving a commission from one of the other academy's



and laterally transferring into the Air Force. ROTC is the base case since these individuals make up the largest percentage of the sample. It is anticipated that those who received their commission through OTS will be more likely to be retained or promoted since a majority of those individuals have prior enlisted experience and already have invested years in the military and have had a realistic job preview. Similarly, those who received their commission through the AFA have demonstrated a preference for the military lifestyle and therefore may be more likely to stay and to be promoted. However, some personnel may have attended the AFA with uncertain career aspirations, which have since been influenced by dissatisfaction with the military or career specialization along with career options in the civilian sector.

Career Field (Ops, Log, Spt, AQF, SD). Career field is a set of dichotomous variables that were created using the DoD Occupation Codes rather than using AFSC data directly, since the Air Force AFSC structure changed in 1993. The base case selected was operations (Ops) since this career field makes up the largest percentage of the sample of officers. Although there are some AFSCs within this career field that are directly transferable to civilian life, the majority are unique to DoD. Logistics (Log) is seen to be likely to have a positive effect as compared to operations, since this career field has the fewest officers, offering unique leadership responsibilities coupled with unique DoD career opportunities. The support (Spt) and acquisition and financial management (AQF) career fields contain the most functions that have direct civilian counterparts but also provide unique responsibilities not available in the civilian sector, and therefore results are expected to be mixed when compared to the base case. The special investigation career field was grouped under the support career field for purposes of this study. Special duty (SD) is expected to have a mixed effect as well, since this career field is sourced from other AFSs and contains both leadership positions and positions perceived as “grooming” for future jobs along with positions that may be perceived as detrimental to a career in the Air Force such as recruiting.

Prior Enlisted Experience (PE, NOPE). Prior Enlisted Experience (PE) is a dichotomous variable, which indicates whether an officer has any previous enlisted experience. It is based on using the begin year of service variable as a proxy to determine whether an individual has previous enlisted time. Officers having no prior

enlisted experience (NOPE) are the base case since the majority of officers do not have prior enlisted service. If an individual has previous enlisted time, it is expected to have a positive effect on retention and promotion given the time invested along with demonstrated taste for a military lifestyle, compared with those with no prior enlisted service.

Current Months in Grade (MIG). This variable is the mean months of service an individual has accrued at his/her grade. This variable is continuous and is measured in months. It provides an estimate of when an individual was promoted along with when the next promotion opportunity exists. As this number increases, it represents more time invested with the Air Force and may reflect risk aversion associated with searching for a new career. For these reasons, the MIG variable is expected to have a positive effect on retention and promotion as it increases.

(3) Education. Current Education Level (BA, MA). Current level of education is a dichotomous variable with the base case being an individual possessing a bachelor's degree since attainment of a four-year degree (BA) is normally a criterion for receiving a commission. Officers who have attained a master's degree, a professional degree, and those with post-masters work or a doctorate were classified as MA. In general, human capital theory predicts that additional education has a positive effect on retention and promotion, however given the internal labor market of the Air Force and standardized pay systems based on time and grade, individuals may elect to pursue alternative employment to maximize their return on additional education, which would have a negative effect. Overall, however, it is believed that MA will be positive in its effects on retention and promotion.

Table 17 provides a summary of all explanatory variables and their expected effects on the dependent variables. For purposes of simplification, only one table is used. As such, if the expected sign is positive for the explanatory variable, then it supports retention and promotion and if negative, it supports separation and failure to be promoted.

Table 17. Variable Names, Descriptions, and Hypothesized Signs

<b><u>Category</u></b>	<b><u>Variable</u></b>	<b><u>Assignment</u></b>	<b><u>Expected Sign</u></b>
<b>Dependent Variables</b>			
Voluntarily Separated	LV	1 = Stay 0 = Not Stay	
Promote	Promote	1 = Promoted 0 = Not Promoted	
<b>Explanatory Variables</b>			
<b><i>Gender</i></b>			
Male	Male	1 = Male 0 = Not Male	Base
Female	Female	1 = Female 0 = Not Female	+/-
<b><i>Race</i></b>			
White	White	1 = White 0 = Not White	Base
Black	Black	1 = Black 0 = Not Hispanic	+
Other Race	Other	1 = Other 0 = Not Other	+
<b><i>Marital Status</i></b>			
Married	Mar	1 = Mar 0 = Not Mar	Base
Not Married	NotMar	1 = Single 0 = Not Single	-
<b><i>Dependents</i></b>			
1 or Less Dependents	OneDep	1 = OneDep 0 = Not OneDep	+/-
2 or More Dependents	TwoDep	1 = TwoDep 0 = Not TwoDep	Base
<b><i>Current Age</i></b>	Age	Continuous	+
<b><i>Accession Source (Commission Source)</i></b>			
Air Force Academy	AFA	1 = AFA 0 = Not AFA	+/-
ROTC	ROTC	1 = ROTC 0 = Not ROTC	Base
OTS & Other Sources	OTS	1 = OTS 0 = Not OTS	+
<b><i>AFSC Career Field</i></b>			
Operations	Ops	1 = Ops 0 = Not Ops	Base
Logistics	Log	1 = Log 0 = Not Log	+

<b><u>Category</u></b>	<b><u>Variable</u></b>	<b><u>Assignment</u></b>	<b><u>Expected Sign</u></b>
Support	Spt	1 = Spt 0 = Not Spt	+/-
Acquisition & Financial Management	AQF	1 = AQF 0 = Not AQF	+/-
Special Duty	SD	1 = SD 0 = Not SD	+/-
<b><i>Prior Enlisted Experience</i></b>			
Prior Enlisted Experience	PE	1 = PE 0 = No PE	+
No Prior Enlisted Experience	NOPE	1 = NOPE 0 = No NOPE	Base
<b><i>Current Months In Grade</i></b>	MIG	Continuous	+
<b><i>Current Education Level</i></b>			
Baccalaureate Degree	BA	1 = BA 0 = Not BA	Base
Master's Degree or Above	MA	1 = MA 0 = Not MA	+

## **V. RESULTS OF ANALYSIS**

### **A. OVERVIEW**

Maximum likelihood (logistic) regression models were estimated to explain the decision to voluntarily stay in the Air Force, and for those who voluntarily stay, the likelihood of being promoted. This was accomplished using the dichotomous dependent variable “Stay” for the retention model and the dichotomous dependent variable “Promote” for the promotion model. Two models were constructed to examine retention, one for the rank of Captain and one for the rank of Major, across the time period from 1992-2006. Only one model was used to examine those who “Stay” and were subsequently “Promoted” to the rank of Major in the time period from 2003-2004.

All the models included the same demographic, professional, and education variables, with the exception of time in grade, which was excluded from the promotion model. Further, the promotion model included a difference-in-difference estimator to measure the effect of an education policy change that occurred during the sample time period. Its purpose was to measure the effects of a 2003 policy change that involved the masking of all educational background information for use in promotion decisions.

Likelihood ratio tests were conducted to determine if the basic models are affected by the addition of specified explanatory variables along with several goodness of fit tests to verify accuracy and statistical significance of each model.

### **B. MODEL RESULTS**

#### **1. Goodness-of-Fit**

Goodness-of-fit measures the validity of the model. Three methods were utilized to test the validity of the retention models. One measure of goodness-of-fit, the global null hypothesis, tests whether or not any of the explanatory variables in the model explain the variation observed in the dependent variable. The null hypothesis states that all of the coefficients are zero and have no effect on the dependent variable. The alternative hypothesis states that at least one of the independent variables explains the variation observed in the dependent variable.

SAS provides three equivalent Chi-Square tests that can be used to test the null hypothesis that at least one of the regression coefficients is not equal to zero in the model. Table 18 shows the results for one of the tests, the likelihood ratio, for the three models that indicate they are statistically significant at the 0.01 level. From this information, we can reject the null hypothesis and conclude that at least one of the independent variables in each of the models explains the variation in the dependent variable, “Stay” or “Promote.”

Table 18. Global Null Hypothesis Test for Logit Models

<b>Model</b>	<b>Likelihood Ratio</b>	<b>DF</b>	<b>Pr&gt;ChiSq</b>
Retention Model for Captain	2318.9277	15	<0.0001
Retention Model for Major	281.6815	15	<0.0001
Promotion Model to Major	88.0140	16	<0.0001

Source: Author

A second technique to measure a model’s goodness-of-fit is based on the R-squared value. The basic R-Squared statistic measures the proportion of the variation in the dependent variable (“Stay” or “Promote”) that was explained by variation in the independent variables. This provides a measurement of the predictive power of the model. Generally, in logistic regression, the basic R-squared is not employed because it does not accurately depict the overall relationship between the dependent and explanatory variables. This is because the maximum possible value for R-squared is less than 1.0 and logit regression by definition has a binary response, either 1 or 0. Therefore, the Max-rescaled R-square converts R-squared values to a scale that has 1.0 as a maximum.

The R-squared and Max-rescaled R-Square values for this model are shown in Table 19. While the two retention models have Max-rescaled R-square values of 17.23 and 15.74 percent respectively, the promotion model had one of 18.80 percent. This indicates that the explanatory variables in the retention models explain roughly 17 and 16 percent of the variation observed in the dependent variable “Stay”, and almost 19 percent of the variation for the dependent variable “Promote.” While a relatively lower R-Square is standard for logistic regression models, the low values for the models indicate that additional explanatory variables may be desirable to improve the model.

Table 19. Basic and Max-rescaled R-Square for Logit Models

<b>Model</b>	<b>Basic R-Square</b>	<b>Max-rescaled R-Square</b>
Retention Model for Captain	0.1059	0.1723
Retention Model for Major	0.0407	0.1574
Promotion Model to Major	0.0237	0.1880

Source: Author

A third measure commonly used to measure goodness-of-fit for a logistic regression model is a classification table that sums correct and incorrect estimates. Classification tables provide a bias adjusted account of the number of events accurately predicted by the model and report them as a percentage. The term “event” in the logit model means that an observation that this predicted, either “Stay” or “Promote,” actually occurs. This percentage is referred to as the percent correctly predicted. It is a measure of the number of correct predictions divided by the number of total observations. The use of classification tables also provides a specificity percentage, which measures false positive and false negative predictions. The probability level in the table is used to determine the percent correctly predicted by the model. It is common to use a probability of .5 that the dependent variable was equal to one to determine the percent correctly classified. A more accurate method is to use the actual number of successes in the model. For the retention models constructed, it is the number of observations where the result is “Stay”=1 of the total number of observations per model, which is the actual proportion of events in the sample. Similarly, it is the number of observations where the result is “Promote”=1 for the promotion model.

The actual proportion of events in each of the three models was .82, .96, and .98, and these cut-off values were used for determining the percent correctly predicted. Table 20 provides a summary of the percent correctly predicted for each of the models. The classification table shows that the retention models correctly predicted 66.5 and 71.7 percent of the events and non-events e.g., “Stayers” and “Leavers,” for each rank. For the promotion model, the table predicted 82.5 percent of the events and non-events e.g., “Stayers” who were “Promoted” and “Stayers” who were not “Promoted.” Further, the sensitivity results, the correct events predicted divided by the total number of events,

have a range of 66 to 83 percent. This indicates that other explanatory variables might be desirable to improve the robustness of the models and to increase the correct number of events predicted.

Table 20. Classification Table for Logit Models

Model	Prob Level	Correct		Incorrect		Percentages				
		Event	Non-Event	Event	Non-Event	Correct	Sensitivity	Specificity	False POS	False NEG
Retention Model for Captain	.82	11171	2618	1184	5752	66.5	66	68.9	9.6	68.7
Retention Model for Major	.96	4700	154	79	1848	71.6	71.8	66.1	1.7	92.3
Promotion Model to Major	.98	3005	26	20	625	82.5	82.8	56.5	0.7	96.0

Source: Author

## 2. Evaluation of Retention Models

### a. Interpretation/Evaluation of Coefficients

There were 15 explanatory variables in the two retention models. Among the 6 demographic variables, all were significant in the Captain retention model, with the exception of dependents. In the Major retention model, only the black and female variables were significant, among demographic variables. Professional factors were all significant for the Captain retention model, with the exception of the AFA variable. In the Major retention model, all of the professional variables were significant, except the OTS and SD variables. In both models, education was significant. Parameter estimates and significance levels are shown in Table 21 and Table 22.



Table 21. Logit Regression Results for Retention – Captain

Model	Retention of Captains N=6781	
Variables	Estimate	Pr>Chisq
Intercept***	-5.0094	<0.0001
Female***	-0.3688	<0.0001
Black***	0.3388	<0.0001
Other Race***	0.3343	<0.0001
Not Married***	-0.2577	<0.0001
One Dep	-0.0490	0.3289
Age***	0.2578	<0.0001
AFA	0.0273	0.5506
OTS***	-0.5619	<0.0001
Log***	-0.9315	<0.0001
Spt***	-1.1638	<0.0001
AQF***	-1.1644	<0.0001
SD***	-0.5364	<0.0001
PE***	0.4673	<0.0008
Months in Grade***	-0.0179	<0.0001
MA***	0.2953	<0.0001

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

Source: Author

Table 22. Logit Regression Results for Retention – Major

Model	Retention of Majors N=3676	
Variables	Estimate	Pr>Chisq
Intercept	0.2230	0.9047
Female***	-0.7118	0.0004
Black*	0.7125	0.0953
Other Race	-0.1134	0.6311
Not Married	-0.2608	0.2042
One Dep	-0.1013	0.5589
Age	0.0627	0.2661
AFA***	-1.19	<0.0001
OTS	0.0629	0.8138
Log**	0.7926	0.0189
Spt**	.5360	0.0131
AQF***	0.5370	0.0049
SD	-0.2359	.8249
PE***	1.3595	0.0009
Months in Grade***	0.0620	<0.000
MA*	0.2643	0.0747

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

Source: Author

Female was statistically significant in both models at 0.01. The parameter estimates were negative, with the expected result being negative. This indicates that females are less likely to stay in the Air Force as compared to their male peers and that gender is a significant factor in retention behavior.

Both of the race variables were significant at the 0.01 level for the Captain retention model, but only Black was significant at the .10 level for retention at Major, with the base case being white. The expected sign of these variables was positive, which was supported by the results in the Captain retention model for both variables, however it was only true for blacks in the Major retention model. The Other Race variable had a negative sign in the Major retention model, which was surprising. This could be a result of the small sample. A test for joint significance was performed to see if together, Black and Other were significant in the model, and they were found to be jointly significant at the 0.01 level in the Captain retention model but not for the Major retention model. Therefore, we can conclude that Race plays a role in retention behavior for Captains but not for Majors.

For the marital status variable, Married was the base case with Not Married (NotMar) being modeled. The expected sign for NotMar was negative. The parameter estimates for Not Married were negative in both models, but only significant at the 0.01 level in the Captain retention model. One possible reason that Not Married was not significant in the Major retention model is collinearity between marital status and the OneDep variable, which measures whether an officer has one or fewer dependents. Therefore, we can only conclude that not being married has a significant negative effect on retention behavior for Captains, when compared to married officers

The variable OneDep was found to be insignificant in both models. The sign of the parameter estimated was expected to be mixed, but the results indicated that having one dependent or less was negative. One possible reason that OneDep was not significant in both models is collinearity with the marital status variable of Not Mar, since the majority of the sample who are not married will not have dependents. Therefore, we can only conclude that the number of dependents is not a significant factor as modeled.

The Age variable was statistically significant for the Captain retention model but not for the Major retention model. It was positive in both cases, which was the expected result. We can therefore conclude that as age increases, it has a strong, positive effect on retention behavior of Captains, but is not as significant for Majors. One possible reason that age is not significant for Majors is possible collinearity between Age and the PE and OTS variables, since prior enlisted personnel are typically older than their peers, and the majority of PE officers went through OTS to receive their commission.

The commissioning source variables of AFA and OTS showed some interesting results, with the base case being ROTC. While the sign of the parameter estimate for AFA was expected to be mixed, the parameter estimate OTS was expected to be positive. In the Captain retention model, the parameter estimate for AFA was positive but not significant whereas the parameter estimate for OTS was negative and significant. However, in the Major retention model, the opposite occurred with the parameter estimate being negative for AFA and significant, and the parameter estimate for OTS being positive and not significant. Collinearity may be a factor with the OTS sample, as discussed above. The results may also be biased since the OTS sample as modeled, includes observations for officers who were accessed from other sources, whose behavior might differ from those whom were accessed through OTS. A test for joint significance was performed to see if source of commission was significant in both models. It was found to be significant in both models. We can therefore only conclude that officers commissioned through the AFA display negative retention behavior at the rank of Major, and officers commissioned through OTS and other sources display negative retention behavior at the rank of Captain compared with officers commissioned through ROTC.

The Career field variables all displayed negative parameter estimates for the Captain retention model at the 0.01 significance level. While the parameter estimates were expected to be mixed, with the exception of Log career field, the results indicate that officers in the Spt and AQF career fields have higher separation rates than those in the base case of Ops. The results in the Major retention model show the reverse effects, with the parameter estimates being positive for all the variables, with the exception of SD, which was negative and insignificant. A test for joint significance was performed to

see if career fields together were significant, which they were in both models. This indicates that job-selection, along with career-progression opportunities, influence an officer's decision to leave or stay at the rank of Captain.

Prior enlisted experience, PE, displayed positive estimates for both models at the 0.01 significance level. This was the expected sign indicating that a prior enlisted officer is more likely to stay than someone who does not have prior enlisted experience, which was the base case. Collinearity may be a possible concern with this variable and the OTS and Age variables.

The parameter estimate for the variable months in grade (MIG) was negative for the Captain retention model but positive for the Major retention model. While significant in both models, the expected sign for this parameter estimate was positive. In hindsight, an expected negative sign of negative may be a more appropriate sign for the Captain model, given the "up-or-out" promotion system. Similar to the Age variable, this variable should increase if an officer stays in the service, since it measures the time spent at a particular rank. However, if an officer is not promoted, it will continue to increase, signifying that the officer was not promoted.

The education variable, Master's Degree or Above (MA), was statistically significant in both retention models at the .01 percent and .10 percent respectively. The parameter estimates were expected to be positive, which they were, as compared to the base case of an officer just possessing a baccalaureate degree. This indicates that an officer who holds an advanced degree is more likely to be retained as compared to a peer who does not. This result supports human capital theory and previous research which indicates that possession of an advanced degree provides less incentive to leave an organization. While the positive parameters may be small, the results support the business practice of employers supporting continuing education in return for increased employee aptitude and company loyalty. While many employees often view health and retirement benefits as a primary consideration when evaluating whether to stay or leave an employer, educational benefits are another important benefit that is often a consideration in retention behavior.

***b. Partial Effects***

The partial effects of the significant variables in the two retention models are determined by using the ‘notional person’ approach. In this case, a white, married male with two or more dependents, who received his commission through ROTC, has no previous enlisted experience, has an AFS in the operations career field, and has a baccalaureate degree. For the Captain model, the mean age is 30.82 years and current months in grade is 28.71 months (2.39 years). For the Major model, the mean age is 35.71 years and current months in grade is 19.29 months (1.61 years).

The partial effects of the significant variables in the models are determined by using the notional person approach, otherwise known as the base case person. The notional person is one who has characteristics that are comprised of the variables that were not included in the model. For the dichotomous independent variables the values were set to zero. If an independent variable was continuous the notional person was assigned the mean value. In this manner, the probability of staying or leaving is established for the typical LAF officer when compared to the overall base case for each individual explanatory variable. Therefore the calculated partial effects are the effects of changes in the dichotomous variables from zero to one and changes in the continuous variables of one unit and compared with the notional individual.

Table 23 shows the partial effects for the independent variables for each retention model. For the Captain and Major models, the notional person has a probability of staying of 91.8 percent and 97.5 percent respectively.

Table 23. Partial Effects for Retention

<b>Models</b>	<b>Retention of Captains N=6781</b>	<b>Retention of Majors N=3676</b>
Female	-0.03223***	-0.024842***
Black	0.02205***	0.012673*
Other Race	0.02179***	-0.002946
Not Married	-0.2150***	-0.007270
One Dep	-0.00374	-0.002617
Age	0.01735***	0.001489
AFA	0.00203	-0.053117***

<b>Models</b>	<b>Retention of Captains N=6781</b>	<b>Retention of Majors N=3676</b>
OTS	-0.05320***	0.001496
Log	-0.10237***	0.013626**
Spt	-0.13983***	0.010308**
AQF	-0.13994***	0.012990**
SD	-0.05026***	-0.006496
PE	0.02884***	0.018597***
Months in Grade	-0.00135***	0.001473***
MA	0.01956***	0.005733*

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

Source: Author

For a LAF officer with the same characteristics as the notional person, except the gender is female, the individual has a decreased likelihood of staying of 3.2 percentage points at the rank of Captain and 2.5 percentage points at Major. The race variables show that if an individual is black, the likelihood of staying increases by 2.2 percentage points at the grade of O3, and 1.3 percentage points for blacks at the grade of O4, compared to a white officer. If an individual is from a other race, the probability of staying increases by 2.2 percentage points at the grade of O3 but decreases at O4 by 0.29 percentage points. Marital status indicates that if an officer is not married, the likelihood of being retained decreases by 21.5 percentage points as a Captain but only 0.72 percentage points as a Major. Similarly, if an officer has one or less dependents, the likelihood of staying decreases by 0.37 and 0.26 percentage points for each rank. For the continuous variable of age, the probability of staying increases by 1.7 percentage points for Captains and 0.14 percentage points for Majors for each additional year of age.

The demographic results are similar to the results found in 2004 Annual Report by the Defense Department Advisory Committee on Women in the Military Services (DACOWITS). The DACOWITS report found that married male and female officers with children were more likely to report an intention to remain in the military over married male and female officers without children. Similarly, the report found that single male and female officers with children were more likely to report an intention to remain in the military than single male and single female officers without children.

Professional factors indicate that if an individual is commissioned through the AFA, he/she has an increased likelihood of staying in the Air Force as a Captain of 0.2 percentage points, but a decreased likelihood of staying as a Major of 5.3 percentage points, when compared to the base case (ROTC). The opposite is true for those commissioned through OTS where the results indicate a decreased likelihood of staying of 5.3 percentage points at Captain, but an increased likelihood of staying as Majors of 0.15 percentage points. All the career fields displayed a decreased likelihood of staying as compared to the notional person in operations as Captains and an increased likelihood of staying as Majors with the exception of officers in special duty, which showed an increased probability of separating at 0.65 percentage points. Prior enlisted experience shows that if an officer is prior enlisted, he/she is more likely to be retained at 2.9 and 1.9 percentage points respectively for each rank. MIG indicates the probability of staying decreases by 0.14 percentage points for Captains but increases for Majors by 0.15 percentage points for each additional month in their current grade.

Given that the focus of this research is on graduate education, the partial effects of the education variable is of greatest interest. Table 23 shows that if an officer has an advanced level of education e.g., a master's degree, a professional degree, or post master's work, he is almost 2 percentage points more likely to stay in the Air Force as a Captain and 0.57 percentage points more likely to stay as a Major than an officer with just a bachelor's degree.

### **3. Evaluation of Promotion Model**

#### ***a. Interpretation/Evaluation of Coefficients***

There were 16 variables in the promotion model. Among the 6 demographic variables, only marital status and age were significant. Several of the professional factors were significant including AFA and the career fields of Spt and AQF. Education was significant at the .10 level. The variable FY04 was significant at the 0.01 level and provides a common time period for the post-policy education change e.g., after 2003. The interaction variable FY04\_MA indicates whether the education policy change

had a positive or negative effect on promotion relative to the pre FY04 period. It was negative but insignificant in the promotion model. Parameter estimates and significance levels are shown in Table 24.

Table 24. Logit Regression Results for Promotion

<b>Models</b>	<b>Promotion of Captain to Major N=3676</b>	
Variables	Estimate	Pr>Chisq
Intercept	-5.0248	0.1609
Female	0.0204	0.9641
Black	-0.2927	0.9641
Other Race	0.0780	0.882
Not Married**	-1.211	0.0111
One Dep	.2486	0.5552
Age***	0.3113	0.0034
AFA**	1.0244	0.0217
OTS	-0.5134	0.2657
Log	-0.0411	0.9576
Spt***	-1.5278	<0.0001
AQF**	-0.9549	<0.0562
SD	10.0706	0.9893
PE	-0.6885	0.2578
MA*	1.5730	0.0890
FY04***	-1.6163	0.0099
FY04 MA	-0.3183	0.7446

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

Source: Author

Female was statistically insignificant, but the parameter estimate was positive, which was the expected result. We can conclude that male and female LAF officers do not vary enough in their promotion behavior, which provides evidence that the promotion system is gender neutral.

Both race variables were insignificant, with the base case being white. The expected sign of these variables was positive, which was partially supported by the estimated signs. The race of Other had a positive sign but the race of Black had a negative sign. A test for joint significance was performed to see if together Black and



Other were significant in the model, and they were found not to be jointly significant. Due to the low insignificance, we can conclude that race does not play a major role in promotion outcomes.

For the marital status variable, Married was the base case with Not Married (NotMar) being modeled. The expected sign for NotMar was negative and the parameter estimate for Not Married was negative and significant at the 0.05 level. This indicates that Captains who are not married who are competing for promotion to Major have a decreased likelihood of being promoted when compared to married officers.

The variable of OneDep was found to be insignificant in the model. The parameter estimated was expected to be unknown, but the results indicated that the effect on promotion on of having one dependent or less was negative. Therefore, we can only conclude that the number of dependents is not significant as it was modeled.

The Age variable was statistically significant at the 0.01 level in the promotion model, which was the expected result. We can therefore conclude that as age increases, it has a stronger, positive effect on the promotion behavior of Captains.

The commissioning source variables of AFA and OTS had some surprising results, with the base case being ROTC. The parameter estimate for AFA was expected to be mixed and OTS was expected to be positive. The parameter estimate for AFA was positive and significant whereas the parameter estimate for OTS was negative and insignificant. While part of this outcome could be explained by the OTS sample containing officers commissioned from other sources which might bias the results, it could also be the result of the promotion system just advancing the “best qualified” in that particular year. Further collinearity may be a concern with the variables of PE and age for the OTS sample that may have influenced the results. A test for joint significance was performed to see if source of commission was significant in the model and it was found to be significant at the 0.05 level. We can therefore only conclude that AFA officers have a stronger likelihood of being promoted as compared to the base case of officers accessed through ROTC.

The Career Field variables all displayed negative parameter estimates for the promotion model, except for SD. While the signs of the parameter estimates were expected to be mixed, with the exception of the Log career field, the results indicate that only officers in SD have an increased likelihood of being promoted. The career fields of Spt and AQF were the only variables found to be significant. A joint significance test indicated that together these career fields are significant.

Prior enlisted experience, PE, displayed a negative estimate for the model. This was not the expected sign, but was insignificant. Therefore, we can conclude the prior enlisted experience is not a factor in promotion.

The education variable, Master's Degree or Above (MA), was statistically significant at the .10 percent respectively. The parameter estimates were expected to be positive, which was the case, as compared to the base case of an officer just possessing a baccalaureate degree. This indicates that an officer who holds an advanced degree is more likely to be promoted. This result supports human capital theory and previous research which shows that personnel who have attained an advanced degree are more likely to be promoted in an organization.

The variable FY04 was significant at the .01 level and negative. This indicates that officers who were eligible for promotion in 2004 were less likely to be promoted than those who were eligible in 2003. This was the expected result, based on examining the promotion rates in the respective two years. (See descriptive statistics in Chapter IV).

The interaction variable FY04\_MA indicates whether or not the effect of education on promotion changed between 2003 and 2004. The parameter estimate was negative as expected given the policy change that involved masking educational backgrounds in information used for promotion decisions. This indicates officers possessing an advanced degree have a lower likelihood of being promoted in 2004 as compared to those in 2003. However, this result was insignificant, which indicates that education levels in 2004 did not have a significantly different effect on the promotion outcomes as compared to the effect of education in 2003.

***b. Partial Effects***

The partial effects of the significant variables in the promotion model are determined by using the notional person approach as explained in Section 2b earlier in this chapter. This methodology allows us to observe the probability of “Promote” when each individual explanatory variable is changed and compared to the overall base case.

In the promotion model, the notional person is a white male, who is married, and has two or more dependents. The mean age is 35.56 years. The notional person also has the following professional and education attributes: 1) commissioned through ROTC; 2) AFS is in the operations career field; 3) the officer has no prior enlisted experience; 4) and the education level is baccalaureate. Table 25 shows the partial effects for the independent variables for the promotion model. For the model, the notional person has a probability of being promoted of 99.7.

Table 25. Partial Effects for Promotion

<b>Models</b>	<b>Promotion of Captain to Major N=3676</b>
Female	0.000062***
Black	-0.0000952
Other Race	0.000216
Not Married	-0.005788**
One Dep	-0.0000625
Age	0.000759***
AFA	0.001814**
OTS	0.001882
Log	0.000118
Spt	-0.010058***
AQF	-0.004478*
SD	0.002830
PE	-0.002830
MA	0.01956*
FY04	-0.011233***
FY04 MA	-0.001221

\*\*\* Chisq statistic significant at .01 level

\*\* Chisq statistic significant at .05 level

\* Chisq statistic significant at .10 level

Source: Author

For a LAF officer with the same characteristics as the notional person, except the gender is female, the individual has an increased likelihood of being promoted at 0.00062 percentage points. The race variables show that if an individual is black, the individual is 0.0092 percentage points less likely to be promoted than a white officer, but if the individual is from an other race, then the likelihood of being promoted increases by 0.002 percentage points. Marital status indicates that if an officer is not married, the likelihood of being promoted decreases by 0.57 percentage points. Similarly, if an officer has one or less dependents, the likelihood of promotion decreases by 0.0006 percentage points, compared to the notional person with two or more dependents. For the continuous variable of age, the probability of being promoted increases by 0.07 percentage points.

Professional factors indicate that if an individual is commissioned through the AFA, he/she has an increased likelihood of being promoted at 0.18 percentage points, when compared to the base case (ROTC). The results are similar for those commissioned through OTS with an increased likelihood of being promoted of 0.19 percentage points. Two of the four career fields displayed a decreased likelihood of being promoted as compared to the notional person in operations, with officers in Spt and AQF having decreased likelihoods at 1.0 and 0.05 percentage points respectively. Prior enlisted experience shows that if an officer is prior enlisted, he/she is more likely not to be promoted by 0.28 percentage points.

Given that the focus of this research is on graduate education and, in particular, the effect of the 2003 policy change, the variables for education level, cohort year, and the interaction of these variables are very important. The partial effects of education show that if an officer has an advanced level of education e.g., a master's degree, a professional degree, or post master's work, he is almost two percentage points more likely to be promoted as compared to a fellow Captain who only possesses a baccalaureate degree. The variable FY\_04 indicates that an officer was 1.1 percentage points less likely to be promoted in 2004 as compared to 2003. The partial effect for the difference-in-difference variable combines the FY04 variable with the education level, which indicates that an individual who possessed an advanced degree in 2004 was .12 percentage points less likely to be promoted than one with the same education level in 2003. This illustrates that the change in Air Force policy had its desired effect although

the difference was not statistically significant, since the Air Force goal was to decrease the perception that advanced education was required for promotion to the rank of Major.

#### **4. Potential Problems with Models**

As with any modeling effort, one potential problem is omitted variable bias. This occurs when important independent variables are either excluded or not available. This bias can result in either a positive or a negative bias in the coefficients for the variables that are included in the model. While the focus of this research is on graduate education, the low Max-scaled R-values indicate that other variables that were not included would have been useful in predicting outcomes. Other variables that might improve the models results for retention might include survey information on quality of life issues, civilian economic employment indexes, or deployment information; for the promotion models, beneficial variables might include completion of Professional Military Education, Promotion Recommendation Form results, and awards. However, given that the focus of this thesis is on graduate education, it might also have been desirable to include the type of advanced degree obtained and the method, if it had been available, along with perhaps GPA and a measure of the quality of the educational institution.

Another concern with logistic regression is the presence of multicollinearity, which is a strong correlation between the independent variables. As discussed in the Interpretation/Evaluation of Coefficients section for each model, collinearity may be present in several of the variables. The existence of collinearity may inflate the variances of the parameter estimates, which may result in the lack of statistical significance of individual independent variables, with the overall model still being significant. The problem of multicollinearity can be overcome by simply taking out variables that are measuring the same thing, combining the variables involved in multicollinearity into a single variable, or by performing joint significance tests for a group of variables that are not individually significant, but highly correlated with each other.

To check for multicollinearity, the models were checked using the variance inflation factor (VIF), which indicates if multicollinearity has increased the instability of the coefficient estimate. While there is no established cutoff value to use with VIF to determining the presence of multicollinearity, values exceeding 10 often indicate

multicollinearity; in weaker models, such as in the case of logistic regression, values above 2.5 may be a cause for concern (Allison, 1999). While the sample size for the study was large, individuals VIFs with numbers that were greater than 2.5 were crosschecked with the correlation table. The correlation table provides correlation factors to assist with ruling out collinearity.

In the retention model for Captain, the variables of Age and PE had a VIF of above 2.5 and the variables of MIG, OneDep, and OTS had a VIF above 1.5. In examining the correlation table, there was some correlation between the variables of Age with PE at 0.6987 and OTS at 0.5560 and months in grade at 0.2977. This was expected given that prior enlisted personnel are, on average, older than their peers; the majority are commissioned through OTS; and as one matures at a given rank, the time in grade increases. Similarly, there was some correlation between OneDep and NotMar at 0.5277, since those that are not married are less likely to have dependents. A similar result occurred for the retention model for Major where a VIF above 2.5 was present in the Age variable. In the promotion model to Major, VIFs above 2.5 were present for the variables of Age, FY04, and FY04\_MA. In crosschecking with the correlation table, Age had a sizable correlation with the PE variable and the OTS variable, as already described. For the variables of FY04 and FY04\_MA, a higher VIF was expected due to the interaction. While it might be desirable to construct a variable that might negate the effect of age on the other variables to rule out collinearity and perhaps add another variable to capture the range of dependents possible, these options were outside the scope of this research.

Although sample size was not a concern for the two retention models, it was a concern for the promotion model. While the sample size was deemed large enough to provide accurate results, the high promotion rates observed in the data are suspicious, which may have affected the statistical significance of the individual independent variables.

## **C. SUMMARY**

The two logistic regression models for retention were successful in determining that graduate education is a key factor in retention behavior for LAF officers. In both the Captain and Major models, possession of an advanced degree improved retention by rates

of 1.96 percent and 0.573 percentage points respectively. Additionally the models illustrated that gender, race, and career fields influence retention behavior.

The promotion to Major model with a difference-in-difference estimator was partially successful in determining that the change in Air Force policy regarding education records being masked in 2003 had an effect on the role of advanced education in promotion. While the expected result was negative, indicating that the policy change had the desired effect of minimizing the influence of graduate education on promotion, the significance level was too low to make any conclusions about the change. A more robust sample for the years proceeding and following the policy change may be needed to draw definitive conclusions about the effect of the policy change. Ideally, this would be actual Air Force promotion board results, so a thorough analysis could be conducted to differentiate between in-the-zone and above-the-zone promotions. Further, a difference-in-difference estimator could be used with data for additional year's post-2003 to provide a more accurate measure of the effects of the policy change.

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## **VI. CONCLUSIONS**

### **A. OVERVIEW**

This study sought to demonstrate the comprehensive value of graduate education to the Air Force. It determined that graduate education is an important influence in retention and promotion behavior of LAF officers. Not only does this information strengthen existing DoD policies that actively support education programs for the benefit of the organization, it also highlights several important individual outcomes, which include increased likelihood of promotion. Although this study was narrow in scope, several key indicators in addition to advanced education were identified that influence retention and promotion behavior. This study also attempted to measure the possible effects of the Air Force policy change regarding educational records being masked for promotion boards in 2003.

#### **1. Primary Research Questions**

The primary purpose of this thesis was to determine the relationship between graduate education and the job performance of Line of the Air Force (LAF) officers. To measure performance, the proxy variables of retention and promotion behavior were utilized to examine the effects of graduate education at the rank milestones of Captain and Major with a sample comprised of officers commissioned between 1992 through 2006.

In examining retention behavior, it was found that graduate education has a significant positive effect on the retention of Captains and Majors. It was determined that possession of an advanced degree, either a master's degree, a professional degree, or completion of post-master's work, increases the likelihood of an officer being retained by 1.96 percentage points for Captains and 0.57 percentage points for Majors. While these percentages are relatively small, this equates to an additional 133 Captains and 22 Majors who could be retained if they possessed an advanced degree based on the sample sizes used in the study. Using this information combined with knowledge of critically-manned career fields the potential exists to help remedy some AFS short-falls. For example, Captains in the support career field have a diminished likelihood of staying of almost 14

percentage points as compared to someone in operations. Potentially targeting advanced education programs to this group, the Air Force might lower the separation likelihood of this group to only 12 percent. Further, combining this information with the other demographic variables, the potential exists to develop policies combined with other pecuniary programs that might improve retention for certain populations that might be under represented such as females and minorities. These findings support previous research that has shown that educational benefits are perceived as an important benefit for military service.

Of the other variables that were utilized in the two retention models, several were found to be significant in their effects on retention. Specifically, gender (female) and career field (other than operations) were negative influences and race (other than white) and prior enlisted experience were positive influences on retention behavior for Captains, while gender (female) and career field positively affected the retention behavior of Majors. This indicates that organizational improvements focused on Captains might improve the retention of females and that changes within career-fields e.g., career-progression enhancements, might improve retention, particularly among scientists and engineers, in the acquisition and financial management career field. These findings are consistent with other studies including DACOWITS and the last Air Force Scientists & Engineers Summit in 2001.

Regarding the effect of graduate education on promotion, only promotion to the rank of Major was modeled given the near 100 percent promotion rate to Captain. It was found that Captains possessing an advanced degree had an increased likelihood of being promoted of 1.9 percentage points. Based on the existing Air Force guidance, this small percentage suggests that possibly the possession of an advanced degree may act as a differentiating factor among equally qualified candidates. Of particular interest among the other variables that were utilized in the promotion model, gender was found to be insignificant. This indicates that the promotion system is gender neutral and that females had an equal likelihood of being promoted that was equal to that of their male counterparts, once other variables affecting promotion were taken into consideration.

## **2. Secondary Research Questions**

The secondary questions that were addressed included reviewing whether the inventory of graduate education skills differs significantly among communities, investigating the perception that graduate education is necessary for promotion, and whether a change in Air Force policy regarding masking education records in 2003 had an effect on promotion outcomes.

In reviewing the levels of education by career field, it was assumed that those in the acquisition and financial management (AQF) fields would have the highest levels of education given that this career field includes scientists and engineers. While this assumption was correct at the rank of Captain with AQF officers comprising 46.27 percent of the sample, what was surprising was the dramatic increase in levels of education, regardless of career field, at the rank of Major. At the rank of Major, there was a two-fold increase in advanced degrees, with the following breakout by career field: operations (57.18 percent); logistics (75.86); support (76.75 percent), AQF (88.49 percent); and special duty (87.50 percent). While not a focus of this study, these numbers support the work by Alley et al., where advanced degrees are perceived as required for officers as they assume more managerial positions, which occurs with a rise in rank.

Through the literature review and the model results, the perception that graduate education is necessary for promotion was investigated in further detail. While historical promotion rates indicate that those with an advanced degree were promoted at a higher rate than those with only a baccalaureate, this may be more a result of unobserved attributes that lead some officers to obtain an advanced degree and become more promotable. Further, in research conducted by Thirtle involving interviews conducted at the Air Force Personnel Center, it was indicated that advanced education was the least important factor in the promotion decision, but an advanced degree could serve as a tiebreaker between otherwise equal officers.

In 2003 the Air Force attempted to change this perception by making the decision to mask education records for promotion boards to the rank of Captain and Major. In doing so, all academic information was masked for the selection board to eliminate any bias towards those with higher levels of education. To explore this policy change, the

promotion model in this study incorporated a difference-in-difference estimator. It was found that the change in policy had a negative effect on the promotion of those with advanced degrees, which was the desired result, but the significance level was too low to make any conclusions about the change. This result implies that the change in policy may have a negative effect on overall education levels at the grade of Captain and Major with fewer officers obtaining advanced degrees for the specific purpose of increasing promotion likelihood. While there is no statistical evidence of this shift in these results, it is implied by the recent reversal in Air Force policy where educational records will no longer be masked starting in 2008. In the 2006 SECAF/CSAF Letter to Airmen, it was announced that starting in 2008 all advanced education will again be part of the promotion process since the 2003 policy change acted as a deterrent for officers pursuing an advanced degree.

## **B. SUMMARY**

The purpose of this study was to examine the effects of graduate education on the retention and promotion behavior of LAF officers. The retention models clearly illustrate that graduate education has a positive and significant effect on retention. While the results of the promotion model were also significant indicating that graduate education affects promotion positively, the data for the time period investigated indicate a very high promotion rate (over 98 percent) whereas the official promotion data indicates a promotion rate of around 93 percent which may have affected the promotion model results. Therefore, a more robust sample for the two years of 2003 and 2004 should be obtained from the Air Force Personnel Center to reevaluate the true effects of the policy change.

## **C. POLICY RECOMMENDATIONS**

As a result of the finding in this thesis, several policy recommendations appear to be warranted:

- 1) The USAF should continue emphasize graduate education to all officers, both through in-residence and off-duty programs. While the Air Force has made considerable

improvement through the developmental education concept, the potential exists to expand in-residence programs using an executive MBA model, where officers would only be required to be away from their duty station for several weeks of the program.

2) The USAF should explore new ways to make graduate education beneficial to both the officer and the Air Force. While not a focus of this thesis, in examining the literature and the retention results, it appears that by properly phasing graduate education for some career fields, retention might be improved through the additional service commitments incurred.

#### **D. RECOMMENDATIONS FOR FURTHER RESEARCH**

This thesis examined the effects of graduate education on retention and promotion of LAF officers at the grades of O3 and O4. Follow-on research could focus on expanding the grades studied to include the senior grades of O5 and O6 and whether the influence of graduate education has a similar effect at these levels. The addition of other variables such as civilian economic employment indexes, deployments, Professional Military Education, and information about the type and timing of graduate education obtained, would also improve the predictive accuracy of the models. Of greater interest in the future may be to compare and contrast the effects of education from the time period of 2002 through 2009, to capture the effects of the two education policy changes along with the drawdown of the officer corps, which is occurring in 2006 and 2007.

Without doubt, the Air Force is in a position to expand its capabilities by investing in the educational capabilities of its officers. By focusing on efforts to make education an integral part of officer development, the Air Force will be continue to be able to meet the challenges of an unknown future.

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## LIST OF REFERENCES

Alley, T., Bolton, E., Findley, B., Mosley, Mwambola, L., Renehen, J., Spivey, G., Thompson, J., and Weinstein, J. "Air Force Graduate and Undergraduate Educational Programs: Need, Structure, and Focus." Paper presented to the Directorate of Research, Air Command and Staff College, Maxwell AFB, Alabama, May 1995.

Allison, P.D. *Logistic Regression Using the SAS System: Theory and Application*, Cary, NC: SAS Institute Inc., 1999.

Becker, G.S., "Investment in Human Capital: A Theoretical Analysis," *The Journal of Political Economy*, v. 70, pp. 9-49, 1962.

Bowman, W. R., and Mehay, S. L., "Return on Investment in Navy Graduate Education." PowerPoint Brief delivered in MN4761, Naval Postgraduate School, Monterey, CA, 2006.

Bowman, W.R., and Mehay, S.L., "Graduate Education and Job Performance: Evidence from the Military," *Economics of Education Review*, v. 18, 1999.

Cymrot, D.J., "Determining the Optimal Level of Graduate Education for Naval Officers," Center for Naval Analysis, CRM 86-11, February 1986.

Cymrot, D.J., "Graduate Education and the Promotion of Officers," Center for Naval Analysis, CRM 86-6, March 1986.

Doeringer, P.B. and Piore, M.J., *Internal Labor Markets and Manpower Analysis*, Heather Lexicon Books, 1971.

Ehrenberg, R.G., and Smith, R.S., *Modern Labor Economics: Theory and Public Policy*, 9<sup>th</sup> ed., Pearson Education Inc., 2006.

Gates, W., Maruyama, X., Powers, J., Rosenthal, R., and Cooper, A., "Faculty Response to the C.N.A. Assessment of the Naval Postgraduate School," Unpublished manuscript, Naval Postgraduate School, Monterey, California, 1999.

Jacobs, T.O. and Jaques, E., "Executive Leadership," in R. Gal and A.D. Mangelsdorf (Eds.), *Handbook of Military Psychology*, John Wiley & Sons Ltd., 1991.

Jordan, S., "An Analysis of the Impact of Graduate Education on the Performance and Retention of General Unrestricted Line Officers," Master's Thesis, Naval Postgraduate School, Monterey, California, December 1991.

Justice, G and Hunnicutt, E. "Plummer Takes S&E 'Road Show' to AFIT," *Wright-Patterson AFB Skywriter.Com* May 2002 [<http://www.afit-aog.org/main3.html>], March 2007.

Kabalar, H., "Multivariate Analysis of the Effect of Graduate Education on Promotion to Army Lieutenant Colonel," Master's Thesis, Naval Postgraduate School, Monterey, California, June 2003.

Lianez, R. and Zamarripa, L., "The Effects of U.S. Marine Corps Graduate Education Programs on Officer Performance: A Comparative Analysis of Professional Military Education and Graduate Education," Master's Thesis, Naval Postgraduate School, Monterey, California, March 2003.

Medoff, J. and Abraham, K., "Experience, Performance and Earnings," *Quarterly Journal of Economics*, December 1980.

Medoff, J. and Abraham, K., "Are Those Paid More Really More Productive? The Case of Experience," *The Journal of Human Resources*, 16 (Winter), 1981.

Office of the Secretary of the Air Force and Chief of Staff of the Air Force, "Letter to Airmen: Advanced Education," 13 April 2006.

Office of the Secretary of the Air Force, "Letter to Airmen: Education and the Airman," 13 April 2006.

Office of the Undersecretary of Defense, Personnel and Readiness, "Population Representation in the Military Services Report – Fiscal Year 2004," [<http://www.dod.mil/prhome/poprep2004/officers/education.html>], January 2007.

Oswald, A.J., "Wage and Employment Structure in an Economy with Internal Labor Markets," *Quarterly Journal of Economics*, v. 99, pp. 693-716, November 1984.

Philips, W., "The Impacts of a Fully Funded Postgraduate Education on Promotion and Command Screen for Fixed-Wing, Carrier-Based Pilots and Naval Flight Officers, Master's Thesis, Naval Postgraduate School, Monterey, California, March 2001.

Rosen, S., "The Military as an Internal Labor Market: Some Allocation, Productivity, and Incentive Problems," *Social Science Quarterly*, v. 73, pp. 227-237, June 1992.

Salop, J. and Salop, S., "Self-Selection and Turnover in the Labor Market," *Quarterly Journal of Economics*, v. 90, pp. 619-627, November 1976.

Schirmer, P., Thie, H., Harrell, M., and Tseng, M., "Challenging Time in DOPMA: Flexible and Contemporary Military Officer Management," RAND Corporation, MG-451-OSD, 2006.

Thirtle, M., "Educational Benefits and Officer-Commissioning Opportunities Available to U.S. Military Servicemembers," RAND Corporation, MR-981-OSD, 2001.



U.S. Department of Defense, "Policy on Graduate Education for Military Officers," DoD Directive 1322, 10 August 2004.

U.S. Department of Defense, "Commissioned Officer Promotion Reports (COPRs) and Procedures," DoD instruction 1320, 13 June 1996.

U.S. Department of Defense, "Defense Department Advisory Committee on Women in the Military Services 2004 Report." [[http://www.dtic.mil/dacowits/annual\\_reports/2004annualreport\\_w\\_cvr.pdf](http://www.dtic.mil/dacowits/annual_reports/2004annualreport_w_cvr.pdf)], March 2007.

U.S. Department of the Air Force, "Active Duty Service Commitments (ADSC)" Air Force Instruction 36-2107, April 2005.

U.S. Department of the Air Force, "Professional Development (Advanced Academic Degrees and Professional Continuing Education)" Air Force Instruction 36-2302, July 2001.

U.S. Department of the Air Force, "Total Force Development (Active Duty Officer)," Air Force Instruction 36-2640, Volume 1, January 2004.

U.S. Department of the Air Force, "You And Your Promotions - The Air Force Officer Promotion Program," Air Force Pamphlet 36-2506, September 1997.

Wise, D. A., 1975, "Personal Attributes, Job Performance, and Probability of Promotion," *Econometrica*, Vol.43, no. 5-6 (September-November), 1975.

Wise, D. A., 1975, "Academic Achievement and Job Performance." *American Economic Review*, v. 65, no. 3: pp. 350-366, 1975.

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